Engineering News-Record

A Consolidation of Engineering News and Engineering Record
McGRAW-HILL PUBLISHING COMPANY, Inc.
January 10, 1918

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UNION PACIFIC REINFORCED-CONCRETE SNOWSHED

In This Issue:

Erecting the Sciotoville Bridge
By CLYDE B. PYLE

Unit-Member Concrete Snowsheds on the Union Pacific
By W. R. ARMSTRONG

Traveling Towers Place 92,000 Yards of Concrete at Steel Mill

U.S. Malleable Iron Co.
Toledo O.
Westinghouse Airbrake
Wilmerding Pa.
Philadelphia Textile
Machine Co.
Continental Motors
Detroit
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Wood Block Floors
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Vulcan Iron Works
Wilkesbarre
Mother Spring Co.
Boiler Shop
Machine Shop

Inductive Interference Studies

After five years' investigation, at a cost of $100,000, the Joint Committee on Inductive Interference, acting for the California Railroad Commission and the utilities of California, has completed its final report. The publication of the result of these extensive investigations depends upon obtaining a sufficient number of advance subscriptions to cover the cost. It is planned to publish a review of the studies and 30 selected technical reports in a volume of about a thousand pages, with 400 drawings and 30 halftones. The price of advance subscription has been set at $10. Those desiring to subscribe should send their names, but for the present no money, to Richard Sachse, chief engineer, California Railroad Commission, 833 Market St., San Francisco, California.

Irrigation and Labor Laws Urged

At the recent fifth annual meeting of the Washington Irrigation Institute, held at North Yakima, Wash., a resolution was passed commending the bill, introduced in the United States Senate by Mr. Chamberlain, of Oregon, which proposes the raising of funds for the irrigation and reclamation of arid lands. In another resolution the state legislature was urged to pass laws to protect the streams of Washington from contamination. Active support was pledged to the state labor commissioner in his efforts looking to better housing, sanitary and social conditions for those engaged in regular seasonal farm labor.

More Special Engineer Regiments Being Organized

Two new engineering regiments for special service in France are now being recruited, and an urgent call has gone out for noncommissioned officers and privates to fill up the quota. The regiments are the 26th Engineers, a new water-supply regiment being organized by Col. E. J. Dent, at Camp Dix, Wrightstown, N. J., and the 37th Engineers (electrical-mechanical) under Maj. A. B. Kratz, at Fort Myer, Va.

The call for the water-supply regiment is not only for the new unit but to supply deficiencies in similar existing regiments already in France. The demands are for stenographers, clerks, teamsters, chauffeurs, electricians, carpenters, surveyors, draftsmen, well-drill operators, tool dressers, blacksmiths, gasoline-engine men, machinists, pipefitters, masons, riggers, plumbers, pump erectors, steam engineers, firemen and blasters and powder men. Officers in this and the other regiment will be taken from the roster of the Engineer Reserve Corps.

The electrical-mechanical regiment is for the purpose of installing operating and maintaining electrical apparatus in France. Here the needs are for stationary engineers, motor-truck drivers, electricians, cable splicers, linemen, expert test men, wiremen, armature winders, machinists, pipe fitters, carpenters, blacksmiths, handy men and cooks. Noncommissioned officers, who will be the skilled mechanics of the regiment, will get pay up to $60 per month plus commutation and clothing.

Tribute to Newlands as Friend of Engineers

Deceased United States Senator Was Father of Reclamation Service Act and Advocate of Inland Waterways Development

By Prof. F. H. Newell
Former Director of United States Reclamation Service

Upon the death of Senator Francis G. Newlands, of Nevada, on Dec. 24, Engineering News-Record *requested Prof. F. H. Newell, former head of the U. S. Reclamation Service, to prepare an obituary notice for this journal. Professor Newell was selected because of his close acquaintanceship with the late Senator. In his tribute Professor Newell calls attention to the services of Senator Newlands to the engineers of the country, especially as the father of the act creating the Reclamation Service. Professor Newell writes:*

In the death of Senator Newlands, of Nevada, not only the people of the United States lose one of the most effective of public servants, but in particular the engineers suffer. Senator Newlands was a man of a rare type—a lawyer by education, but with broad constructive ideals and a single devotion to nation-wide problems accompanied by no trace of personal or sectional ambition. It was due to his patience and perseverance that one of the greatest engineering attempts of the Government was successfully inaugurated, that of the Reclamation Service, which in the mind of Senator Newlands surpassed in future importance to the people of the United States even the building of the Panama Canal.

Francis Griffith Newlands was born at Natchez, Miss., on Aug. 28, 1848, and died on Christmas eve, Dec. 24, 1917, being more than 69 years of age. Up to the hour of his death he was devoting his thoughts and energies to the great constructive problems of legislation. He had before him the plan of the Federal relations to the railroads which he as Chairman of the Interstate Commerce Committee of the Senate was and had been studying with his usual thoroughness. Death struck him down at the critical moment of the climax of his plans and at a time when he had but a few hours before finished a conference with President Wilson. The latter, following the death of Mr. Newlands, immediately put into effect some of the carefully thought out plans.

A student at Yale College in the class of 1867, young Newlands later studied at the Columbia Law School, and in 1874 married the daughter of Senator Sharon, later becoming a trustee of the Sharon estate, which owned, among various properties, the Palace Hotel and other enterprises in and about San Francisco. Some years after the death of his first wife he married Edith McAllister, of a well-known California family, and in 1889 removed to Nevada, from which state he was elected as representative in Congress, serving during the years 1893 to 1903, inclusive. As representative he framed the well-known Newlands or Reclamation Act, which became a law by the signature of President Roosevelt on June 17, 1902.

As senator from Nevada since 1903 he was able to furnish needed support and encouragement, not only to the engineers in the practical operation of the Reclamation Act, but in other broad measures. He was vice chairman of the Commission on Inland Waterways and introduced legislation looking toward a still larger development of some of the principles embodied in the Reclamation Act. He was the first public man to use habitually the now well-worn phrase of "coördination and coöperation." He introduced bill after bill having in view the education of his colleagues along these lines and for the ultimate bringing about of a unity of plan of action in the treatment of the water resources of the country, beginning with the mountain and forested areas, down through the problems of water storage, of irrigation, of drainage, of development of power, of the prevention of floods and protection against them, and finally of navigation, with harmonious inter-relation of land and water transportation systems. He had the vision not only of the needs of the country but also of the possibilities, and while almost ridiculed at times for his persistence, he kept insisting upon the need of action until, in the River and Harbors Bill of Aug. 8, 1917, there was finally incorporated as Section 18 the authority for appointment by the President of a commission of seven members to take up the varied but inter-related subjects of water control and use.

Senator Newlands regarded this commission as a great possible factor in the use of engineering judgment and skill in the development of the nation's resources, and almost with his last breath urged prompt and vigorous action such as that authorized by the law.

Joint Societies' Meeting in Idaho

A joint conference of engineering, agricultural, livestock and irrigation societies of the State of Idaho will be held at Idaho Falls, Jan. 14-19. The plan for the conference contemplates sessions of the various societies in sectional meetings.

Caution, Not Pessimism, Should Rule

Other Factors Than First Cost Likely To Govern New Work—Need Construction To Make Rail Systems a Unit

With the purchasing public in a stronger position than in years, and with a tremendous demand for supplies, added on account of the war, we have a situation which in other times would point to great construction activity on the part of private interests. As a matter of fact, however, private construction is likely to continue at a low ebb. This is not on account of high prices. First cost is only one of the items which an owner of a structure has to consider, and more often than not it is of secondary importance. Neither is the slackness due to panic or to anticipation of a panic. It is due to caution, to careful consideration of those things we need most to insure a successful outcome to the war. With the economic burdens of the war likely to fall heavily on us by reason of the disorganization of Russia, men are looking forward to a real struggle, which will, if necessary, tax the resources of the country to the utmost. In this frame of mind people are confining their purchases to necessities, and are thinking twice before putting up a building not urgently needed, or before constructing a plant to make anything which does not contribute to the conduct of the war.

Contractors reflect this caution by turning to Government construction work, and by avoiding speculative building or enterprise which the contractor must finance, and from which he cannot expect an early return for the reason that the products of the enterprise do not appeal to the present temper of the public.

These tendencies are curbing the speculation which results in too much construction in times of ordinary business expansion. As a result, the contractor will be in a position of great potential strength when the struggle ends. The country will be under-built, rather than over-built. In view of this object, it is better to take care of the war work and of the private work needed to keep up our national efficiency than to attempt to stimulate construction. Enough work is to be done in producing the needed munitions plants, industrial dwellings, transportation facilities and Government buildings, to occupy the field, if present estimates hold. This is the sort of work which will be done without reference to prices, as no matter what must be paid for materials and labor, it is by far the most economical course to provide the facilities at once and hasten the winning of the war.

Contractors, moreover, are likely in general to be protected against direct loss by the form of contract on such work. It is most probable at the same time that their profits will be held down by the same means. The material and labor markets, however, will not cease to be of importance. Rather, interest in them will shift more markedly from quotations to supply, and, in the last analysis, to the supply of labor for producing the materials. It appears at present that the task will be more in the nature of securing additional labor to increase the supply of some construction materials than by way of curtailing production to release men for more important work. The war construction is going to require great quantities of cement, lumber and steel. For while it is true that the entire two billion feet of lumber used to date in the Administration's construction program is but 5% of the lumber production for 1917, it yet represents a large total compared to the lumber used by contractors aside from house building.

The Government, in taking over the railroads, has outlined a policy which will result in operating them as a unit. Before this can be done, however, many physical connections at rail centers must be provided or improved. For instance, the announcement that the Pennsylvania tunnels in New York City will be used to handle the business of all of the Jersey railroads to the Long Island waterfront implies the construction of trackage to connect these roads to the Pennsylvania. There is no doubt as to the economy, or rather necessity, of carrying out all the construction required to make the important roads over into a single system, and, with the unlimited resources of the Government at their disposal, it will be easy for those in charge to carry out the work. Developments in the railroad field are, therefore, brought nearer rather than postponed by Government control so far as can be judged in the brief time since the roads were taken over.

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, 29 West 39th St. New York; Jan. 16 and 17, 1918. New York; Charles Warren Hunt, secretary.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, 35 Nassau St., New York; Jan. 14, New York; F. A. Molitor, secretary.

NEW ENGLAND WATER-WORKS ASSOCIATION; 715 Tremont Temple, Boston; Jan. 9, Boston; Willard Kent, secretary.

AMERICAN WOOD PRESERVERS' ASSOCIATION; Baltimore, Md.; Jan. 22-24, Chicago; F. I. Angier, Baltimore & Ohio R.R., Mount Royal Station, Baltimore, Md., secretary.

CANADIAN SOCIETY OF CIVIL ENGINEERS; Montreal; Jan. 21-23, Montreal; Fraser S. Keith, 176 Mansfield St., Montreal, Can., secretary.

AMERICAN INSTITUTE OF MINING ENGINEERS, 29 West 39th St., New York; Feb. 18-21, New York; Bradley Stoughton, secretary.

AMERICAN CONCRETE INSTITUTE; 27 School St., Boston; Feb. 7-9, Chicago; H. B. Alvord, secretary.

ENGINEERING SOCIETIES

At the December meeting of the **Cincinnati Engineers' Club**, Dec. 20, the president, Prof. A. M. Wilson, gave an illustrated talk on "Illumination." After the annual dinner the following officers were elected to serve for the year 1918: Prof. A. M. Wilson, president; E. A. Muller, vice president; E. A. Gast, secretary treasurer; G. M. Braune, O. F. Shepard, Jr., and F. W. Willey, directors.

The Minnesota Joint Engineering Board will hold its annual meeting at Duluth, Feb. 22. The constitution of the board provides that one meeting a year be held in which all the affiliated societies participate. The entertainment features for this meeting, and for that of the Minnesota Surveyors' and Engineers' Society, noted above, are in the hands of the Duluth local organization of the members of the American Society of Civil Engineers.

The Dec. 20 meeting of the **Oregon Society of Engineers**, Portland, Ore., was devoted to a discussion of the paper on "Irrigation and Our National Food Supply," by Percy A. Cupper, assistant state engineer, Salem, in the December bulletin of the society.

The Engineers' Club of Trenton, N. J., held a special meeting Dec. 27, at which Major Richard C. Marshall, Jr., Quartermaster Corps, U. S. Army, assistant to Officer-in-Charge of Cantonment Construction, presented an address entitled "Engineering and Construction Features of Cantonments."

At the annual meeting of the Victoria, B. C., branch of the **Canadian Society of Civil Engineers**, the following officers were elected for the ensuing year: Chairman, R. W. MacIntyre; vice chairman, R. Fowler; secretary, E. G. Marriott; treasurer, E. Davis; other executive members: W. K. Gwyer, E. P. McKie; auditors: F. C. Green and C. Hoard.

The Engineers' Club of San Francisco at its weekly luncheon, on Dec. 18, was addressed by W. J. Crook, metallurgical engineer of the Pacific Coast Steel Co., on "Steel." The speaker discussed the present and future Pacific Coast possibilities and also the relation of the steel industry to the war.

The San Francisco Association of Members of the American Society of Civil Engineers held a regular meeting on Dec. 18 at which six speakers, in 10-min. talks, presented their ideas on "Why Engineers Have Not Achieved A Higher Rank Among the Professions." In order that the greatest lasting benefit might result from the suggestions and ideas presented, a committee was appointed to compile same for publication and report at the next

meeting upon the entire matter. New officers were elected for the ensuing year as follows: President, Jerome Newman, second vice president, W. C. Hammatt; secretary treasurer, Nathan A. Bowers.

The 336th meeting of the **American Institute of Electrical Engineers** will be an intersectional meeting held in Boston, Jan. 8; New York, Jan. 11, and Chicago, Jan. 14. The same paper will be presented and discussed at the three places. It is entitled "Effects of War Conditions on the Cost and Quality of Electric Service," by Lynn S. Goodman and William B. Jackson, and is given under the auspices of the Committee on Economics of Electric Service. The paper will be presented at the New York meeting by Mr. Goodman and at the Boston and Chicago meetings by Mr. Jackson. Nonmembers of the institute are invited to attend and take part in the meeting.

PERSONAL NOTES

SAMUEL YOUNG, of New Orleans, has received a commission as captain in the Engineer Officers' Reserve Corps and has been ordered to a training camp.

JOHN L. COLLINS has moved his office from 238 Central St., Lowell, Mass., to the Sun Building, Lowell.

G. N. WHEAT, of Kansas City, Mo., is now a captain in the 113th Engineers, at Camp Shelby, Mississippi.

CLIFFORD M. KING, of Sandusky, Ohio, has been commissioned as captain in the 313th Engineers, at Camp Dodge, Iowa.

LIEUT. GORDON D. COOKE, who was stationed at Detroit, is now with the U. S. Geological Survey at Hachita, New Mexico.

GEORGE SCHOBINGER, who was with the U. S. Reclamation Service at Garfield, N. M., is now with the American International Shipbuilding Corporation, at Philadelphia.

EARL F. REAGAN, formerly of Colorado Springs, Colo., is now connected with the work being done at the Norfolk, Va., naval base by James Stewart & Co., Incorporated.

L. J. BORSTELMANN, formerly chief draftsman for the Mason & Hanger Co., at Camp Zachary Taylor, Kentucky, is now chief estimator for the American International Shipbuilding Corporation at Hog Island, Pennsylvania.

ALBERT D. CASE has resigned as engineer of structures, Boston & Albany R.R., with headquarters at South Station, Boston, and has become structural engineer in charge of the structural division of the American International Shipbuilding Corporation.

B. G. SLINING, for the past 18 months construction engineer in charge of power house construction for the Illinois Traction System, with headquarters at Peoria, has resigned to become constructing engineer for Robert W. Hunt & Co., on the Standard Oil Co.'s $2,000,000 coal and power development at Carlinville, Illinois.

WILLIAM H. WARDWELL, of Westmount, Que., has become a major in the Engineer Officers' Reserve Corps, U. S. Army.

LAWRENCE GRIFFITH, consulting engineer, of Yonkers, N. Y., has been appointed city engineer of Yonkers, succeeding DANIEL F. FULTON.

F. M. SHARP, formerly assistant engineer of the District of North Vancouver, B. C., has been appointed acting engineer to succeed JOHN MCCREADY, resigned.

J. A. BROUK, who was until recently engineer on a filtration plant at Flint, Mich., for the Pittsburgh Filter Manufacturing Co., has been commissioned second lieutenant in the infantry section of the reserve corps, U. S. Army.

L. R. MCWETHY and RALPH A. BEEBEE have formed the firm of Beebee & McWethy, superintendents of construction, with offices in the First National Bank Building, San Francisco.

ROGER W. OLMSTED has been appointed chief engineer of the South San Joaquin Irrigation District, California, to succeed A. GRIFFIN, resigned. Mr. Olmsted has been connected with the district for nearly five years and is familiar with the plan and policy developed by Mr. Griffin. Just prior to his promotion Mr. Olmsted was resident engineer for the district on the reconstruction of the Hilts concrete flume line.

R. E. WHITAKER, who was formerly assistant engineer with the city engineer's office, Los Angeles, Calif., is now with the California Highway Commission, with headquarters of division 2 at Dunsmuir, Calif. Mr. Whitaker served for six months as first lieutenant in the Engineer Officers' Reserve Corps at various camps, but was disqualified for further service by a slight heart defect.

LUZERNE S. COWLES, for the past eighteen years connected with the designing department of the Bureau of Elevated and Subway Construction of the Boston Elevated Railway Co., has resigned to accept a position with Stone & Webster, Boston, as structural engineer. Mr. Cowles was born in Hartford, Conn., in 1876, and was graduated from the Massachusetts Institute of Technology in 1897 in the Department of Civil Engineering. He was a prime mover in connection with the organization of the Engineers' Club in Boston, and has been secretary of the organization from its beginning, in December, 1911.

GEORGE G. ANDERSON, consulting engineer, Los Angeles, Calif., has resigned from the advisory board of consulting engineers of the Imperial Irrigation District.

FREDERIC I. WINSLOW has been appointed supervising engineer, U. S. Navy, and is first assistant to the resident engineer of the U. S. Emergency destroyer plant at Squantum, Mass. He has obtained a leave of absence from the City of Boston for this purpose, and expects to resume his old position as engineer in charge of the Water Department as soon as the work at Squantum is finished.

PROF. E. A. STONE, who holds the chair of structural engineering and bridges at Queen's University, Kingston, Ont., has been offered the chair in engineering of the new Chinese Government University of Engineering in North China.

F. G. EASON, senior drainage engineer in charge of the work of drainage investigations in South Carolina, with office at Charleston, working under the U. S. Department of Agriculture, Office of Public Roads and Rural Engineering, will sever his connection with the office on Jan. 5 to attend the Engineer Officers' Reserve Corps camp at Camp Lee, Petersburg, Va., as a captain.

F. E. KURZENKNABE, formerly with the Louisville & Nashville R.R., at Lexington, Ky., as engineer and supervisor of the Lexington yards of the railroad, and charged with the building of the Jefferson St. and West Main St. viaducts, has been appointed highway engineer and manager of the Fayette County Road Department, Lexington, Kentucky.

OBITUARY

JOSEPH HOBSON, chief engineer of the Grand Trunk Ry. from 1896 to 1907, and from the latter year to the present time consulting engineer of the system, died Dec. 19, at Hamilton, Ont., at the age of 84 years. Mr. Hobson had a virtually continuous record of service with the Grand Trunk system since 1858, when he entered its employ as assistant engineer on construction work west of Toronto. From 1870 to 1873 he was resident engineer on the International bridge at Buffalo. In 1873 he was made chief engineer of the Great Western Ry., now a part of the Grand Trunk system, and two years later he became chief engineer of the Great Western division of the Grand Trunk. He held this post 20 years, and then was made chief engineer of the entire system. Among the structures, in addition to the International bridge, which he put through are the

St. Clair tunnel, the Victoria bridge over the St. Lawrence River, and the reconstruction of the old suspension bridge below Niagara Falls. Mr. Hobson was a member of the American Society of Civil Engineers, the Canadian Society of Civil Engineers and the Institution of Civil Engineers.

JOSEPH E. YOUNG, civil engineer and railroad builder, died in Chicago, Dec. 19, at the age of 86. He helped to build the first Fort Wayne R.R. into Chicago and also the first pumping station in the city. He organized and built the Chicago, Danville & Vincennes R.R., now the Chicago & Eastern Illinois R.R., and built also sections of the railroads that are now the Illinois Central R.R. and the Santa Fe System.

HENRY BELIN, JR., president of the E. I. du Pont de Nemours Powder Co. of Pennsylvania, died at his home in Scranton, Penn., Dec. 25. Mr. Belin was 74 years old. He was born at West Point, N. Y., the son of Major Henry Belin, of the U. S. Army. In 1860 he went to Scranton as the representative of the Du Pont company and continued in that capacity for more than fifty years.

WILLIAM H. YOUNG, Locke, N. Y., superintendent of highways and president of the Cayuga County Highway Superintendents' Association, died Dec. 18, aged 60 years.

HENRY A. HERRICK, consulting engineer of the Montana Power Co. and designer of large dams and works, died in Butte, recently.

BUSINESS NEWS

Frank W. Hall has been appointed commercial manager of the Sprague Electric Works of the General Electric Co. With the exception of a short period, Mr. Hall has been connected with the Sprague Works continuously for 22 years in various engineering and sales capacities, and for the three years prior to his present appointment occupied the position of sales manager. D. C. Durland, former executive head of the Sprague Electric Works, has resigned to accept the presidency of the Mitchell Motors Co., Incorporated.

The National Dredging and Lighterage Co. moved its offices Dec. 27 from the Pennsylvania Building to the North American Building, Philadelphia.

The Pacific General Contracting Co., Seattle, Wash., composed of John L. Hall and E. L. Skeel, was recently organized to conduct the general contracting business.

Wallace T. Roberts, formerly sales engineer for the Sullivan Machinery Co., in lower Michigan, northern Ohio and northern Indiana, has been appointed district manager at Denver, succeeding Capt. Matt R. Blish, Ordnance Department, U. S. A., acting manager at Denver since last May. George W. Blackington, formerly manager at Denver, is now captain, commanding the Third Battalion, 353rd Infantry Regiment, National Army, at Camp Funston, Kansas.

J. N. Ebling, president of the Railway Specialties Corporation, New York City, has been called to the colors and is now at Camp Upton, Long Island. D. A. Munro has been made secretary of the corporation and is taking charge of Mr. Ebling's work at present.

I. R. Garretson, now lumber agent of the Chicago & Eastern Illinois R.R., is leaving that road Jan. 1 to become traffic manager of Marsh & Truman Lumber Co., Chicago. Mr. Garretson succeeds Capt. A. Fletcher Marsh and F. L. Bronez, who have successively entered the U. S. Army.

TRADE PUBLICATIONS

The Consolidated Expanded Metals Cos., Bradodck, Penn., has issued a booklet, "Military Camps of Our Allies," describing in brief form the use of expanded metal lathing for frame buildings in England, France and Belgium, and stating that most of the permanent camps in these countries are built with expanded metal. The book describes also other "Steelcrete" products of the companies, such as expanded metal for concrete reinforcing and expanded metal special meshes.

Hayward Catalog No. 44, describing the application of various types of Hayward buckets to industrial plant uses, has been received from the Hayward Co., 50 Church St., New York. In addition to illustrations of various installations, the catalog gives blueprint elevations and plans of the several forms of buckets operated by overhead traveling cranes, etc., are given.

The Wilson Welder & Metals Co., Inc., 52 Vanderbilt Ave., New York, has issued Catalog No. 2, describing in detail the Wilson electric welding system and specially prepared welding metals. Blueprints are included showing layout of complete welding sets.

The "Cut-Weld" combination torch for cutting and welding is described in a new circular issued by the Alexander Milburn Co., Baltimore, Md. This concern is also sending out a folder describing the new Milburn "Reliance" portable carbide light.

The Jeffrey Manufacturing Co., Columbus, Ohio, is sending out a stock list, showing material actually on hand, covering chains and attachments for elevators and conveyors, buckets, conveyors, bearings, hangers, pulleys, etc. Approximate shipping times are included. This list is to be issued semimonthly.

The Eureka Machine Co., Inc., Lansing, Mich., has issued a new catalog describing line of batch concrete mixers, including a new low charging type that has been recently developed by this company.

Bulletin F-3, entitled "Watertight Concrete," has been issued by the Hydrated Lime Bureau of the National Lime Manufacturers' Assn., Pittsburgh, Penn. It describes the use of hydrated lime in connection with concrete structures.

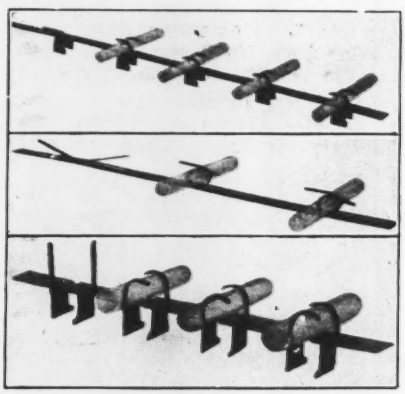
The Blaw-Knox Co., Pittsburgh, Penn., is sending out a new folder describing the "Blaw" Speedster bucket, also booklet describing the "Blaw-Ransomixer."

Titan motor trucks are described in a new catalog issued by the Titan Truck Co., Milwaukee, Wisconsin.

APPLIANCES AND MATERIALS

Spacer for Reinforcement Stamped from Sheet Steel

A new line of reinforcing bar spacer is being put on the market by the Universal Form Clamp Co., Chicago. The general form of these spacers can be seen from the illustration in which the top view shows the type used for spacing bars in slab construction. The spacer can be furnished in any length desired. The supporting teeth are fastened at any specified interval and are double-locked to the strip by arms and clips. These teeth are of a standard height.



VARIOUS FORMS FOR VARIOUS REINFORCEMENTS

The second illustration shows a strip designed to be used with the Universal slab spacer described above, where two course of rods are required by the design. This strip is simply laid on top of the lower rods after they are fastened to their support. The third illustration shows the Universal beam saddle. These are similar in all respects to the slab spacer, except that their supporting legs can be furnished in any specified height. In both the first and the last design any size rod can be provided for at any spacing that may be desired.

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. McGRAW, *President*

ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

Volume 80 — NEW YORK, THURSDAY, JANUARY 10, 1918 — Number 2

Who Will Be First with a Municipal War Program?

THE need for municipal war programs was urged and some of their elements were outlined in these columns a week ago. This is the time of the year when thousands of city managers, city engineers, water, sewer and street commissioners and superintendents, mayors and city councils, are making their plans for 1918 work. Or, if previously made, the critical exigencies of world war for national and individual liberty demand that many of the 1918 plans be remade. Who will be first to report a well-conceived municipal program for the next three or five years, either for the whole city or for a single department—a program designed to help win the war for democracy with the least possible sacrifice and increased burden on the part of the municipal citizenship?

Water-Power Development by Government Action Unlikely

IT IS easy to demonstrate that under present financial conditions, water-power development on a large scale can be undertaken only if the Government furnishes the money. It is almost equally easy to demonstrate that Congress is little likely to undertake any such radical program at present, in view of other pressing demands upon the Treasury. Nor can state work for water-power development be deemed among the probabilities. Governor Whitman of New York urged it in his annual message, but the state comptroller, who holds the purse strings, declares in his report that the state must reduce all new construction work and cut down expenses in every way possible. A very brisk and interesting debate may be counted on between the advocates and opponents of Government operation whenever either State or Federal Government seriously approaches the project of water-power development by public funds, but at present such a discussion would be academic.

Proposed Constitution for Civil Engineers

AT THE annual meeting of the American Society of Civil Engineers in New York next week, the proposed revision of the constitution will come up for discussion. For such an important document, the new constitution has had relatively little attention. On trips last year, the editors of *Engineering News-Record* found strangely little interest in it, though that situation may have been changed by the official sending out of the constitution last month. There are two features of the proposed revision, however, which merit special attention. The first of these is the provision by which district representatives would be voted for only by the members in that district. The second is that which would repose full authority to suspend and expel members in the board of direction. The first of the changes, we believe, requires no argument. It is in line with tendencies toward democratization which have been apparent for years. The second provision merits adoption because it substitutes a workable plan for the present unwieldy method of disciplining members. It is questionable just what results can be obtained even by concentration of the powers in the board, but certainly it promises greater effectiveness than the present scheme. We have no doubt that these two provisions, if given proper consideration, will prevail.

President Vindicates Railroads' War Board

NOT because of any dereliction or failure on their [the Railroads' War Board] parts, but only because there were some things which the Government can do and private management cannot"—this, the President told Congress in his special message of January 4 was the reason for the Government taking over the railroads. Of course many have concluded without consulting the facts that private management failed utterly in emergency. It is refreshing that our chief executive feels otherwise and expresses his views so unequivocally.

An Added Protection Against Explosions

IN ONE respect the Halifax explosion repeated—with proportionate intensity—the experience of the Black Tom explosion in New York Harbor over a year ago and the Grand Central Station explosion in New York in 1910, namely, the relative effect on plain and wire glass. An observer in Halifax reports that all of the ordinary window glass in the poorer dwelling section, which was all but wiped out, was completely shattered, the only vestiges to be found being long, needle-like slivers which drove into walls and furniture, which wounded and lacerated many, and caused the most pitiful of all the casualties—total blinding. In downtown Halifax plain glass suffered a like damage, but the wire glass, which was used in a few of the more modern structures, where it could not stand intact against shock merely cracked or broke in large fragments which did not fly or scatter. In contrast to most of the openings,

the windows in which wire glass was used were sufficiently protected after the explosion to resist a fire exposure which fortunately did not come. Explosions as heavy as those at Halifax and Black Tom are not common near large cities, but in these days some sort of an explosion is at least as probable a risk as an earthquake or a tornado, against which structural precautions are more and more frequently being taken. This demonstration of the safety of the wire-glass window adds an argument in favor of that material, already an accepted protection against fire invasion, particularly for places of large congregation such as schools and factories.

Utilizing Engineering Students—a Need and a Plan

HARDLY had the engineering schools and the profession adjusted themselves mentally to the rulings promulgated by General Black, whereby engineering students might complete their training, before the Signal Corps proposed a different plan which it hopes will produce 500 graduates of the class of 1918 who will be adept in the theory and practice of radio-engineering. Another method this, differing in particulars, but with results much the same—a second enlisted reserve to be composed of physically fit students above eighteen years of age who will devote the full time of the second term of their senior year to the study of those topics which will fit them to a special purpose, that of military communication.

This proposal has not yet been passed upon by the Secretary of War, but before the echoes of its announcement have died away, rumor has it that the Ordnance Dept. is to come forward with a third plan, couched in very similar terms and intended to reserve a few hundred mechanical and chemical engineers for specialized training. Nor is even this the end. At the recent meeting of the American Physical Society resolutions were passed petitioning that additional regulations be made permitting certain students in pure science in the universities to complete their studies to the end that they may more thoroughly function in such technical research as will prove of most benefit to war industries or to the military arm of the country.

This situation cries for a centralization of intelligence and authority. However unfortunate it may be, the moment finds Washington with no committee or board properly constituted to undertake the work of examining either the needs of the various and partially conflicting branches of the service, or the most efficient and practicable methods of serving them. True, the Federal Board for Vocational Training has offered its appropriation and organization to this end and has, in a measure, rendered a certain aid to the Signal Corps. But the board recognizes and admits that in matters of higher education it can serve only as an administrative organ, and attempts to handle the question by merely bringing the representatives of the engineering schools to Washington so that they may discuss with army officers, in a huge debating society, the details of an adequate curriculum. Certainly it does not seem reasonable that a board, limited by law to the study and furtherance of secondary education and effectively organized solely to that end, could also be the proper agency to undertake the mobilization of the universities and colleges of engineering—even though war does justify many expedients.

Soon Secretary Baker must come to a decision which will result in order. The possibility of third-rate medical schools flourishing as refuges for draft dodgers is atrocious. Nor is there anything of particular appeal to loyal engineers in the thought that the technical schools, cross-raked by the needs of different services, may be given the opportunity to degenerate into nests for similar intriguers. A complete coördination of the existing conflicts of interest must be effected immediately.

The *Engineering News-Record* believes that a new agency should be created for this purpose. The need is so paramount that the superficial complications of one more board or committee is of no consequence if some semblance to the rational may result. What is needed is a small body of authorities, with investigational and advisory power, through which the resources of all institutions maintained for higher scientific education may be adjusted to military needs. This body of men would find it a simple matter, and one consuming but little time, to reduce the fast growing complexity to an ordered plan.

Lest there be the usual accusation that it is easier to propose a general scheme than to reduce it to practice, the *Engineering News-Record* advances the following program:

Let the Secretary of War appoint a board composed of an officer of the general staff; one man thoroughly representative of the medical, dental and veterinary schools; a man who can speak with knowledge of the situation existing in colleges teaching pure science; an authority in higher industrial education; and someone who is competent to speak for the engineering schools. Such a board could make a study of the necessities of the army for young men trained in science or its application, and from it would issue the advice as to how the demand could be filled with the greatest despatch and with the least interference with the progress of other war preparations. They could devise the needed courses of instruction, could rule on the fitness of this or that school to supply the needed training, and, counting on the undoubted loyalty of these institutions, could suggest means through which existing educational facilities might best be utilized to the advantage of all concerned.

It should not be difficult to find men thoroughly equipped for this work. But immediate action is called for, and if reason is to rule, some method such as is suggested above will soon be adopted.

An Expression of Engineering Tendencies

IT WAS characteristic of an earlier period of our engineering that excess material was considered well applied if it saved labor. A wall, for instance, was built plain because it took less labor than to build it paneled, though the latter construction gave equal strength. Abroad an opposite tendency was manifested, labor being expended in order to save material; and in this difference lay one great distinction between the

engineering practice of the New World and the Old. For a generation past the course of progress here has been toward greater efficiency in use of material. In a measure, striving after economy of material marks the present era of American enginering. This fact is to be remembered in studying the remarkable bridge-erection work described in this issue by the contractor's field engineer. The complex operations involved had the object of making the material of the bridge available in full efficiency for carrying the loads, by eliminating those unproductive, waste stresses commonly called secondaries. In carrying out this object—a pioneer undertaking, since the same thing has never been attempted before in anything but fragmentary manner—a great deal of labor was expended. There may be divergent opinions on the wisdom of copying the procedure, just as there are disagreeing views on the importance to be accorded secondary stresses in bridges. But despite this the Sciotoville erection has set a new milestone along the path of structural progress. It is the climax of a generation's development away from the practice of saving labor at the expense of material, and represents typically the present aim to get one hundred per cent. efficiency out of constructive materials.

Government Definition of Its Highway Policy Necessary

THE planning of highway work is either at a standstill or is proceeding in the dark. The Federal Government policy with reference to highway work has not been declared. Until it is, officials responsible for this agency of transportation cannot proceed intelligently or with enthusiasm.

The present chaotic condition is due to two causes. The Treasury Department and the officials of the Federal Reserve Banks are, very properly, discouraging the financing of all private enterprises and of public works which cannot contribute to the winning of the war. In their general declarations they have not specified highway work as a war essential, and road bonds therefore rest under the general ban. Secondly, Priority Order No. 2 forbade the shipment in open cars of road-building materials and equipment after Nov. 1. This order conveyed the impression that Washington did not regard highway work as of first importance.

It is true that Priority Order No. 2 has been suspended, but that suspension does not define the attitude of the government on highways, for all priority orders have been suspended, making way for the adoption of an intelligent, workable priority plan. On the other hand, there is very clear government definition of its attitude with reference to other transportation agencies. Shipping is now the foremost of the problems with which the government is concerning itself. The taking over of the railroads speaks clearly as to the attitude on that transportation agency, while it will be only a few days before appropriations are made for a large program of barge construction for use on inland waterways. As to the electric railways and the highways, however, there is neither definition of policy nor action which will show the importance which the government attaches to them in the war transportation scheme.

The need for immediate definition is evident. The highways are being called upon to carry an immense tonnage which the railroads cannot handle. While good results toward clearing up railroad terminal congestion can be expected from the centralized control under the Director General of Railroads, it is certain that the traffic strain will be great and that every feasible agency of relief must be made ready. That such is the belief of government officials is indicated by the barge-construction program.

If intelligent work is to be put upon the highways during the season of 1918, word as to the government's attitude can come none too quickly. First, the congestion-relieving roads must be determined and their requirements worked into a well-digested work program. Then the funds will have to be appropriated, allocated and raised, and finally all of the detail for the actual construction or maintenance of the roads arranged. The last step in itself involves tremendous problems. If bids are invited as in the past, very little work will be let. Contractors will not take all of the risk of the present rising and uncertain material and labor markets. The states, where they have not now legal authority, must secure legislation to permit the letting of cost-plus-fixed-fee or similar contracts, or to allow the work to be done by force account.

Even if the definition should come today the time is all too short for the best handling of these tremendous problems. Fortunately the definition need not be complicated. Three elements are necessary:

First, recognition of the necessity for the maintenance and construction of those highways which will relieve railroad congestion and which are necessary for the most effective prosecution of the war.

Second, recognition of bond issues for roads of the type described in the preceding paragraph as essential war financing.

Third, announcement that upon approval of designated Federal agencies, railroad cars will be forthcoming for the transportation of the construction and maintenance materials and machinery needed for war-necessity roads.

Of course, such a declaration will need later elaboration, but once the policy is clear, there are recognized agencies of the government, such as the Office of Public Roads and the Highways Transport Committee, through which this elaboration can readily and logically be made. For example, there must be machinery for passing upon the programs for war-road construction and maintenance. Definite procedure will need to be established for the approval of bond flotations and for securing railroad accommodations for the construction materials and equipment. All these details will logically and necessarily follow a declaration on the three main points.

Fortunately, the highway program for the season of 1918 is now in the hands of one man. The present uncertainty is due to the discouragement of bond issues and to the shortage of railroad equipment. The financial question is determined by the Secretary of the Treasury, the other by the head of our railroad system. These two positions are now combined in one man, Mr. McAdoo. We have no doubt that once he finds the time, amid his exceedingly pressing duties, to put his mind on the matter, the declaration for which highway departments in forty-eight states are waiting will be quickly forthcoming.

The Prospect for Water-Power Development

Congress Will Probably Enact Legislation at This Session, but Financial Situation Makes Raising of Capital Difficult

BY CHARLES WHITING BAKER
Consulting Editor, *Engineering News-Record*

FOR nearly a dozen years, water-power development in the United States has been practically at a standstill, awaiting legislation by Congress. Federal legislation is necessary because the Federal Government controls the navigable rivers of the country and owns the public lands in that great section west of the Mississippi, on which are located the principal sites where water power may be developed under high head.

Congressional legislation on water-power development in the years 1890 to 1910 was inspired by the idea that the corporations must be prevented from grabbing valuable public property. One of these laws, for example, provides that corporations may be granted permits by the Secretary of the Interior to develop water power on streams under Federal control, but this permit is subject to revocation by the Secretary or any of his successors. The governing idea of the framers of the law, doubtless, was that the Secretary would only use this power of revocation to punish a wicked corporation which deserved to have its right to do business taken away; but it was overlooked that the chief sufferers from such a punishment would be the holders of the corporation's bonds and stocks, and that people would be slow to invest their money in water-power enterprises where a total loss might result if the company's managers incurred the ill-will of any Secretary of the Interior.

For ten years Congress has been wrestling with bills providing more favorable terms for the investment of capital in water-power sites under Government control. Engineers who are familiar with the problems of water-power development have taken an active interest in the framing of this legislation; but the general public and the majority of intelligent business men even, have known and cared little concerning it. Without public interest manifested, legislation is apt to lag.

WHAT A "REVOCABLE PERMIT" MEANS TO INVESTORS

Nearly a year ago something happened which gave an object lesson on the water-power situation to a group of influential men. When a famine in paper and wood pulp threatened to interfere with the newspaper industry, the idea occurred to certain prominent newspaper publishers of starting their own independent pulp and paper mills. They found there was plenty of pulp wood in the Government timber reserves in the West; and for the praiseworthy task of "bucking the trust" the Government authorities agreed to grant them permits for its use on favorable terms. They found there was plenty of undeveloped water power in the same region and the Government authorities were equally ready to grant favorable permits for its development under the existing Federal statute.

All seemed to be plain sailing for the new enterprise and so the publishers went to investment bankers asking them to sell the bonds to enable the plant to be constructed. The bankers promptly replied that they neither could nor would sell bonds to their customers the security for which might be at any time destroyed at the caprice of a Cabinet officer.

The publishers then for the first time understood why new Federal legislation is absolutely necessary to break the existing deadlock in water-power development. They at once began a campaign of public education on the subject which has had wide-reaching effect.

THE COAL SHORTAGE ARGUMENT

More potent, however, than any written or spoken word in teaching the need of water-power development in the public interest has been the widespread shortage of coal. Engineers have been urging for a dozen years that water power ought to be developed to conserve our rapidly diminishing coal supply; but the average business man has comfortably argued that he had always been able to buy all the coal he needed at a moderate price and there was no use in worrying about the future.

To thousands and millions of people the shortage of coal has taught some greatly needed lessons. Many engineers, even, probably appreciate better today than they ever have before what it really means to have the power that operates a public utility or an industry furnished from a source that goes on forever and that is not subject to interruption by strikes at the mines or blockades on the railways or by such a great excess of demand over supply as now exists.

It is in recognition of this aroused and educated public opinion doubtless, that Gifford Pinchot (who has for years been the leader of the forces which have worked for restrictions in Federal legislation for water-power development) says in his latest public statement: "The thing to do with water power is to develop it."

THE ADMINISTRATION'S WORK FOR LEGISLATION

The chief obstacle to the passage of the necessary legislation has been the contest in Congress among the advocates of different pending bills. To meet this situation a bill has been prepared under the joint direction of Secretaries Baker, Lane and Houston of the War, Interior and Agriculture departments. At a White House conference on Jan. 4 of Congressmen interested in water-power legislation President Wilson announced that this Administration bill will be reported by the Rules Committee of the House, which is expected to ensure its prompt passage there. The bill creates a Water-Power Commission, made up of the three Secretaries above named, with authority to grant 50-year licenses for water-power developments on public lands and on navigable streams.

In order to harmonize differences that may arise

over details of the Administration bill and other pending bills, a joint committee of 15 from the House Committees on Commerce, on Agriculture and on Public Lands was created. It is probable that a similar committee will be formed in the Senate to harmonize differences there. The outlook for the passage of a water-power bill by Congress is therefore most favorable.

It is of special interest to note that the commercial interests of the country are alive now to the water-power situation. Following a resolution presented at the Atlantic City meeting of the National Chamber of Commerce last fall, a special committee of the Chamber has been appointed to investigate water-power development and needed water-power legislation. The committee is to meet at Washington on Jan. 14 and 15. The engineering profession is represented on this committee by Prof. George F. Swain of Boston.

The Difficulty in Selling Bonds

No survey of the prospects for water-power development would be complete which did not take cognizance of the existing financial situation. Two years ago, or even a year ago, private capital was ready for investment in a number of water-power enterprises whenever the uncertainties as to Government control were eliminated. Today only the most favorably situated water-power propositions could hope to float bonds for this work, even with a secure 50-year franchise and ample provision for the investor's protection in its operation. What private companies may and probably will do, in the event of favorable legislation by Congress, is to set engineers at work on surveys, plans and specifications, so that their schemes may be ready to submit to bankers when the financial market returns to normal condition.

Admittedly this will not give the country the prompt development of water power that is imperatively needed; but it must be remembered that the Government's drafts on investment funds in floating its war bond issues have made all other financing difficult.

The late Henry G. Stott, as chairman of a committee of the American Institute of Electrical Engineers, in a statement submitted to the National Waterways Commission in 1911, estimated the average investment at that time in a hydro-electric plant at $150 to $300 per horsepower. At the present time, in view of the enormous advance in labor and materials since 1911, and especially in electrical machinery, which constitutes much more than half the cost of a hydro-electric plant, it is probable that the cost of hydro-electric development has risen to $250 to $500 per horsepower. A private company floating bonds for a new water-power plant at the present time would probably have to pay, including broker's commissions, etc., at least 7% for the money. Hence its interest charges alone would amount to $17 to $35 per horsepower per annum. When to this is added the operating expenses, taxes and depreciation, the price the company would have to charge for its power is raised so high that only under exceptionally favorable conditions could the water power compete with steam power.

It is clearly evident from the above that water-power development is closely dependent on a favorable material and labor market, and especially on a favorable investment market; and also that the existence of even a small annual rental value or franchise tax from a water-power company as consideration for its permit might in many cases under present conditions destroy the margin of profit that makes the scheme worth while to its projectors.

Water-Power Development by the Federal Government

The question will doubtless be raised whether if private capital cannot at once take up the work of water-power development under present commercial and financial conditions, the Government itself should not undertake the work. Strong arguments could be made both for and against such a procedure, but a sufficient answer at the present time, probably, is that the Government has its hands more than full already with work that it must perform and is finding great difficulty in performing efficiently.

The Government has no engineering organization experienced and competent in the work of hydro-electric development which it could place in charge of such work. If the Government were to attempt to create such an organization, at the present time at least, the result would almost certainly be a dismal failure. If the Government desires to promote the prompt development of water power, therefore, its best course would be to assist in the financing of enterprises planned and carried out by private concerns. It would be possible to work out a plan by which the Government's investment would be secure, and the reduction in fixed charges through the lower interest rate due to the Government's credit would make possible the development of many power plants which at a higher rate of interest would be impracticable.

State Water-Power Development in New York

A somewhat better case might be made out in support of Governor Whitman's proposal, in his annual message last week, that the State of New York should itself undertake the development of some of the unused water powers within its borders. New York is in a unique position among the states, because in the construction of its new barge canal a large amount of water power has been created and it appears reasonable that the state should develop this power and either lease the plants or sell the power at the best possible price. Again, the state's own engineering staff years ago worked out projects for great storage reservoirs on lands owned by the state, with resulting enormous benefits in both water-power creation and flood prevention. The state must doubtless do this work if it is to be done at all.

Here again the financial situation will doubtless be the deciding factor. Even though all the opposition to the state's entering the water-power business were overcome, there would still remain the objection that the state should not float bonds for public works at a time when the Federal Government is demanding all available capital for its war loans. The barge canal water power, however, has been to a large extent already created in the process of canal construction, and the additional investment necessary to make it ready for the market would be moderate in amount, so that this work might perhaps be undertaken at the present time.

Problems and General Methods of Erecting the Sciotoville Bridge

First of Three Articles on Original Plan Employed, with Elimination of Secondary Stresses, in Placing Large Two-Span Continuous Structure of Chesapeake & Ohio Northern Railway Over Ohio River

By Clyde B. Pyle
Field Engineer for McClintic-Marshall Co., Pittsburgh

THE erection of the Sciotoville bridge of the Chesapeake & Ohio Northern Ry. across the Ohio River had to meet an unprecedented requirement on the part of the engineer in charge of this structure, Gustav Lindenthal—namely, that the members be built together in such a way as to neutralize the secondary or distortion stresses under dead plus half live load. Other facts, however, helped to make the task a formidable one. The structure is of very unusual type, being a two-span continuous truss. It is of record-breaking size, each of the two spans being 775 ft. long and the depth over the center pier being 129 ft. 2 in. c. to c. of chords. The resulting weight and size of the members and connections, and the necessity of erecting at least one of the two spans by the cantilever method in order to maintain an adequate navigation channel, contributed to the difficulties of the work.

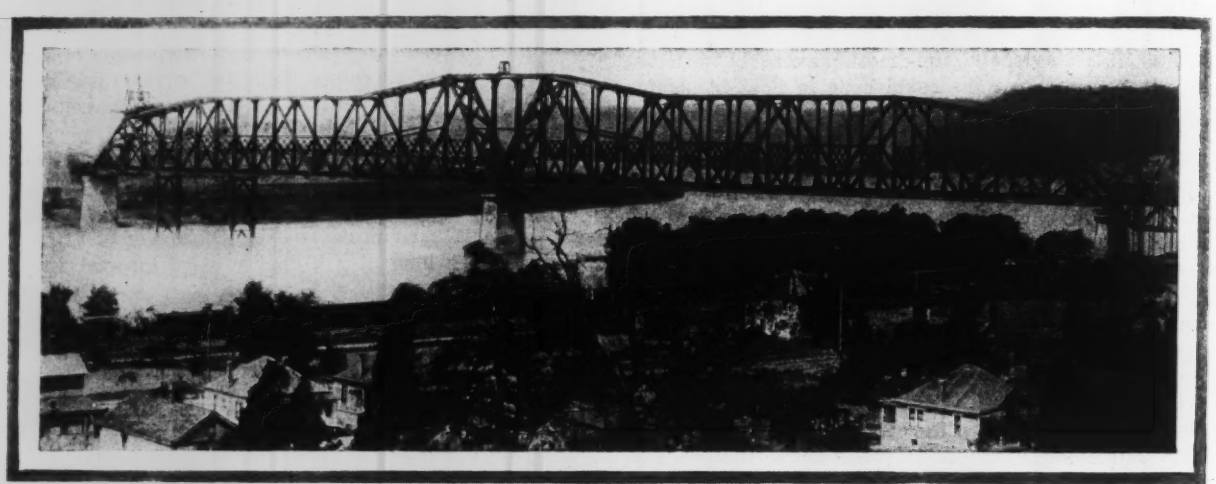


FIG. 1. THE TWO 775-FOOT SPANS OF THE SCIOTOVILLE BRIDGE COMPLETED. CREEPER TRAVELER AND TEMPORARY BENTS NOT YET REMOVED

The unusual form and proportions of the bridge are apparent from Fig. 1, and from the diagram Fig. 2, in which the dimensions are also given. The truss members were very heavy and of large section, therefore unusually stiff; they weighed up to 90 tons, with a cross-section of 596 sq.in. The structure presented an erection problem necessitating careful investigation and leading to several novel and interesting features in the erection methods.

Several auxiliary conditions must be noted: (1) All connections in the structure are riveted; the bridge is by far the largest fully-riveted truss bridge in the country. (2) Not only the great length of the members—up to 75 ft.—but also the fact that during erection the stress in some instances was opposite to that in the completed structure made the changes in length for camber very large and increased the distortions required to connect the members. (3) The distortions were in some cases so large that in making the last connection of a triangle the rivet holes were entirely blind. In many cases the members were too stiff and heavy to have the holes brought fair with pins. Special jacking devices had to be used to bring the connections into match.

It should be said in advance of all further explanation that the erection was successful in every way. The members were erected in distorted condition just as required by the engineer for elimination of secondaries. The contractor's equipment and methods for securing this result proved successful and productive of only the expected degree of extra cost and time. In two cases, where heavy members had to be held by the traveler falls until rivets were driven, a delay of virtually two days occurred. In splices such as the U2 hip where the holes did not match perfectly a large number of drift-pins were driven. This also occurred at top-chord splices in the Kentucky span. Bottom-chord sections were supported on a flying bridge while the splice was being riveted, and the balance of the steel in the panel was erected at the same time. In these cases the delay was not noticeable, but the cost was somewhat increased. No accident to the structure interrupted the progress of the work.

The Ohio River at Sciotoville has a 60-ft. range, and floods may occur very suddenly. Running drift and ice

in winter and spring, and a current that makes falsework erection difficult, uncertain and dangerous at all except very low stages, had to be reckoned with. The bridge site is at one of the worst bends in the river. It has the peculiarity, furthermore, that the Ohio side, although on the outside of the bend, is shallow; rock

The extreme overhang of the Kentucky cantilever, which would have required much extra metal to provide for erection stresses, was reduced by placing two temporary steel bents under the landward portion of the Kentucky span. There was room also for two panels of falsework adjacent to the center pier, which was of

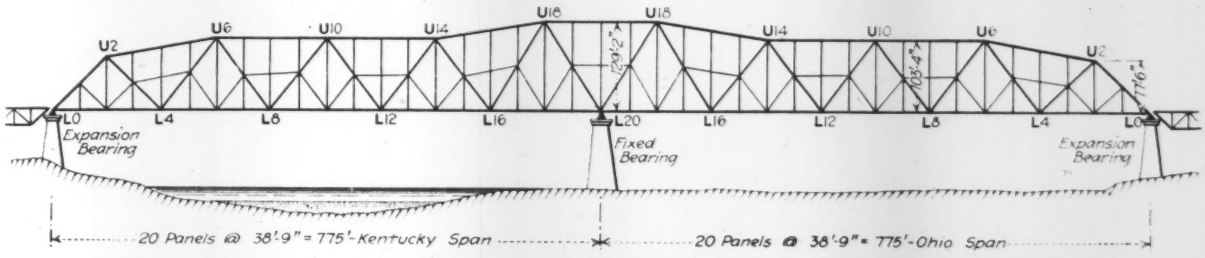


FIG. 2

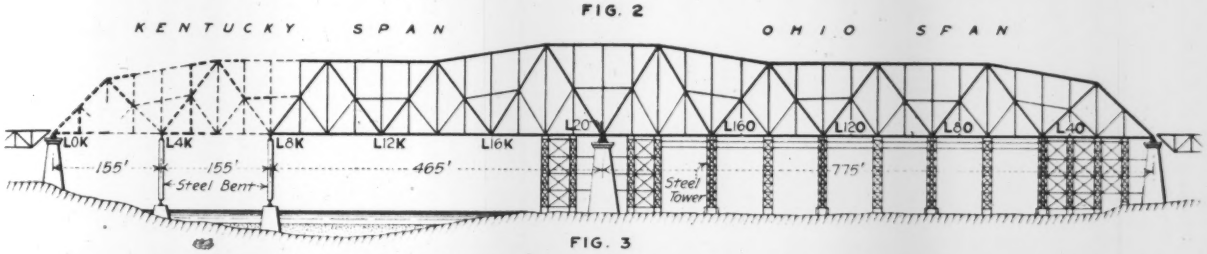


FIG. 3

FIG. 2. SCIOTOVILLE BRIDGE REMARKABLE FOR CONTINUOUS SPANS, WARREN WEB SYSTEM, GREAT SIZE, AND PROPORTIONS OF DEPTH AND PANELS

FIG. 3. FALSEWORK SYSTEM FOR ERECTION—THE LOW-WATER CHANNEL IS ON THE KENTUCKY SIDE, BUT IN FLOOD THE MAIN CURRENT IS ON THE OHIO SIDE, CREATING DANGER TO FALSEWORK

bottom is at the low-water level here. The low-water channel, therefore, is on the Kentucky side, while at flood time the principal current is on the Ohio side.

A clear width of 370 ft. had to be kept open in the Kentucky channel at all times during construction to pass the large tows of coal barges. This dictated cantilever erection for the Kentucky span and falsework erection for the Ohio span. The arrangement of supports resulting from these and other conditions is shown in Fig. 3. It will be noted that the falsework had to be placed where the ice hazard is greatest.

It was decided to anchor the Ohio falsework with rockfilled cribs and to build it up as separate towers placed far enough apart to allow drift and ice to pass between them. The panel length of the bridge being 38 ft. 9 in., a spacing of two panels for the larger part of the falsework was considered necessary. Piles could not be driven, but 12 x 12 posts were placed singly on the rock bottom and bedded at low water.

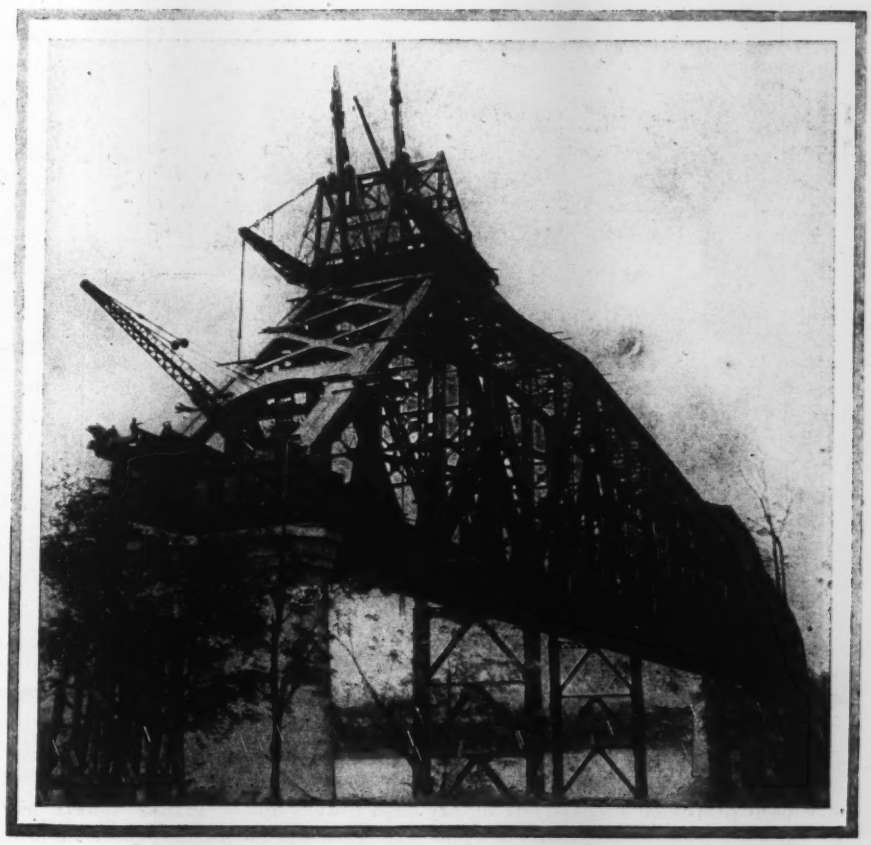


FIG. 4. THE CREEPER TRAVELER'S WORK COMPLETED AT THE KENTUCKY END PIER

service in erecting only the main triangle of the trusses over the center pier.

The design of the falsework was governed by the great weight of the bridge. Originally it was intended to erect about one panel of the Kentucky span as a cantilever to two of the Ohio span on falsework, and to carry the unbalanced load of the Ohio span on steel towers placed at the main panel points. By so doing the progress of erection would be more rapid and the load on the Ohio falsework would be lessened. The Ohio end was to have been supported successively on the steel towers as the erection progressed. This scheme was abandoned when the Kentucky span was completed to only 17 in order to rush the Ohio span to completion as a safeguard against a possible ice jam. The span was left supported on *all* the steel towers (155 ft. apart) since it was not selfsupporting until the Kentucky cantilever was nearly half completed. Thus, should the 70-ft. openings between timber towers have proven too small to allow an excessive run of ice to pass, or should the timber towers have been badly cut by the ice, the steel towers with 155-ft. openings would have supported the span until the Kentucky cantilever was of sufficient length to make it safe to swing the Ohio span.

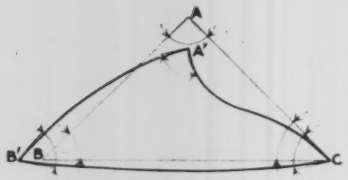


FIG. 5

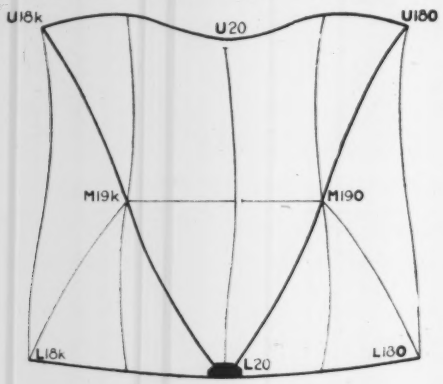


FIG. 6

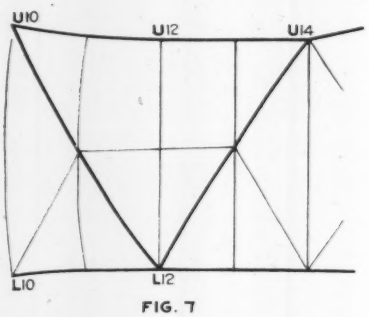
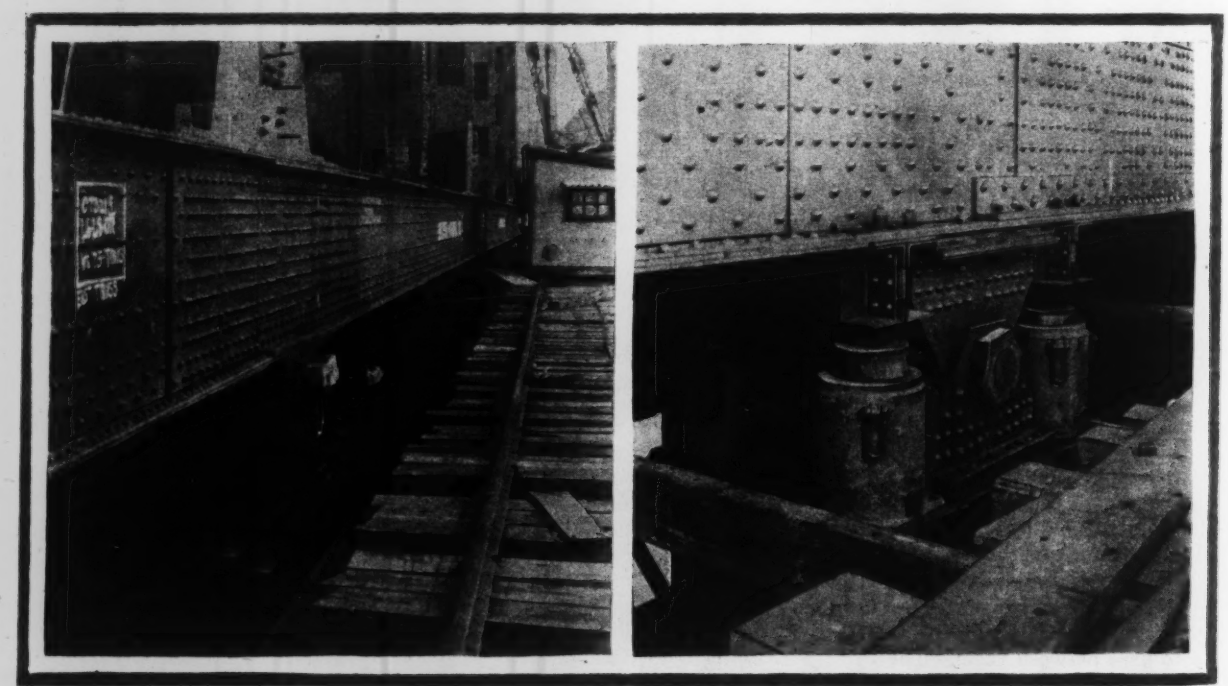


FIG. 7

FIG. 5. HOW THE MEMBERS OF A TRIANGLE MUST BE BENT TO BECOME STRAIGHT UNDER FULL LOAD
FIG. 6. DISTORTION OF MIDDLE FOUR PANELS WHEN ERECTED
FIG. 7. OPENING AT U10 REQUIRING JACKING TO MAKE CONNECTION



FIGS. 9 AND 10. THE BOTTOM CHORD OF THE OHIO SPAN RESTED ON WEDGE JACKS ON THE TIMBER FALSEWORK, WHILE ON THE STEEL SUPPORTS ROOM WAS LEFT FOR HYDRAULIC JACKS

Timber towers were used for temporary support of the floorbeams midway between steel bents. The timber towers were built wide enough to carry the traveler track outside of the trusses.

On account of the two-panel spacing of falsework towers to pass drift and ice, 70-ft. girders belonging to the permanent approaches to the bridge were used to span between towers. The 42 girders available provided for seven spans of the falsework, using in each span two girders to carry the intermediate floorbeams, and two girders under either gantry traveler runway. This gave seven openings; the remainder of the falsework, near the two piers, had towers at every panel point.

Since the rigid joint connections of the bridge hold the members in fixed angular relation, the members must bend as the bridge deflects under load. By erecting the members with a bend exactly the opposite of the bends which they would normally experience at a given stage of loading, the effect is secured of having the members come straight and therefore free from secondaries at this particular stage of loading. The designer of the bridge, Gustav Lindenthal, specified that this result was to be attained under half live load.

The bridge thus has high secondary stresses under dead load, but the secondary stresses decrease as live load comes on, and are fully neutralized under half live load.

If the various joint connections of the bridge had all been reamed and riveted as erection progressed, with the members straight and unstrained, the desired angular relations would not have been secured, as the subsequent distortion under load would have caused bending in the members and hence secondary stress. It was necessary, therefore, to assemble the truss in the shop and ream

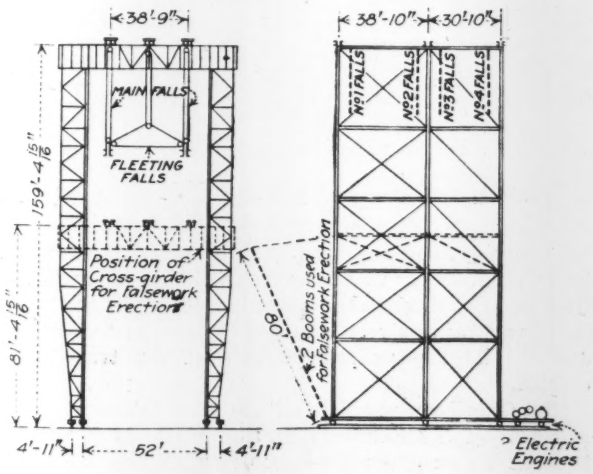


FIG. 11. ERECTION GANTRY USED FOR OHIO SPAN

the connections with the members meeting at such angles as would result after distortion of the bridge by load. This was done as follows:

Every member was originally built to such a length that when erected and under the influence of one-half full live load the bridge would be of its diagram size (Fig. 2). The members when laid together unstressed would therefore not have the diagram angles at the joints. As the joint connections were to be reamed to the diagram angles, the shop had a problem in reaming the connections. Of any triangle of the bridge, only two corners could be fitted up at a time. After these were reamed, one corner was disconnected and the member shifted to make possible the reaming of the third connection. This had to be done with every triangle in the bridge. The angles were laid out accurately with a transit instrument, and distances were measured or checked in the early morning while the steel was of uniform temperature.

In order to connect the three members of any one triangle thus prepared, with rivet holes matching, the

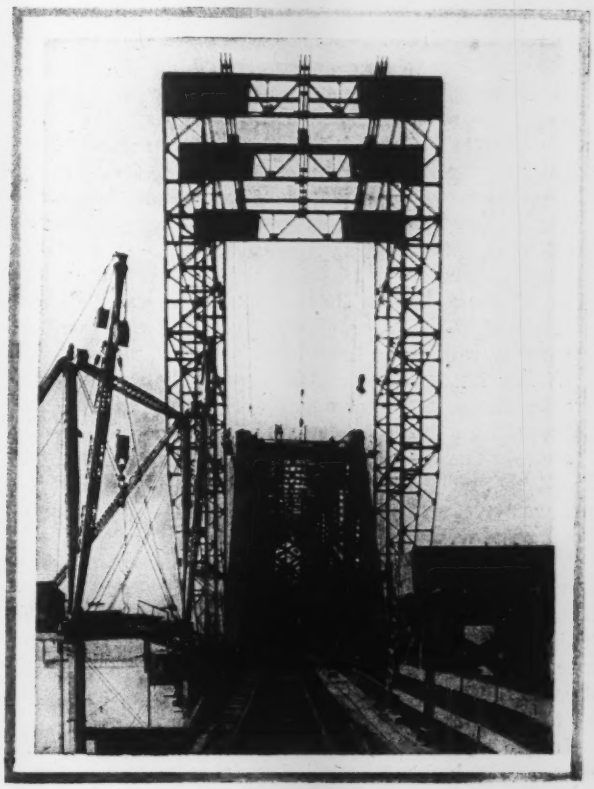


FIG. 12. FULL-HEIGHT GANTRY AS USED FOR OHIO SPAN TRUSS ERECTION

members had to be forced together, distorting them about as sketched (in greatly exaggerated form) in Fig. 5. In nearly every such triangle one member, in this case *AC*, is relatively very light and flexible, and can bend more easily than the two stiffer members. The general problem in the erection of the bridge trusses was to secure the proper angle at *B*. In placing the light member *AC* a few pins at *C* and *A* easily brought good holes and therefor the proper angles at *C* and *A*. Jacking was often required to bend the heavy members or to stretch the light members to get pins started at *C* or *A*.

One of the serious problems in bringing about this distortion was encountered in the four middle panels, illustrated by Fig. 6. Here the members are extremely heavy. As none of them will ever undergo reversal of stress in the completed bridge, and since they will always be under large stress in the completed bridge, their changes in length for camber are comparatively large. During their erection the direct stresses were virtually zero. Unusually heavy forcing was required to bring the members together. The two joints shown open in Fig. 6 were left unconnected until both spans

were swung and the chords had become virtually straight.

Extensive computations were made in order to determine for every member and splice in the bridge just how much the holes would mismatch at one point when the other end of one of the members was normally connected, and also to determine the force necessary at the free end to bring the connection fair.

These computations were made in order to predetermine the location of the free end of each member during erection, and the secondary stress produced by bending the member to its connection; and also for the purpose of designing equipment and rigging of sufficient strength to force the members into true connection.

Much of this distortion during erection was accomplished by the main falls of the two travelers. In addition, however, a large amount of jacking was necessary. In the Ohio span, wedge jacks were provided on the timber falsework, and hydraulic jacks on the steei falsework (see Figs. 9 and 10), to adjust the vertical position of the bottom chord while making various connections of the web members. The jacks could be used for either raising or lowering.

In the Kentucky span the bottom-chord joints and middle joints of submembers were made with Norton jacks set on a flying bridge suspended from the creeper traveler. These jacks supported the projecting end of a chord section just placed, until the splice at its rear end was riveted, and thereafter raised the chord for allowing the web members to be connected to it.

The top-chord joints at the main panel points were brought to connection by means of two 200-ton hydraulic jacks used in a specially designed jacking yoke. This was shown in service by the cover picture of the Dec. 13 issue of *Engineering News-Record;* Fig. 7 indicates the location of one of the gaps pulled together by this jacking yoke.

In the top-chord splices of the Kentucky span driftpins usually had to be applied to draw the two pieces of chord into true tangency at the splice; the holes were almost fair without any forcing, and drifting was sufficient to make the connections. The top chord rested on posts at all but main panel points. In the Kentucky cantilever erection these posts held the chord too high at the free end to allow perfect holes at the splice, in a few cases. The kink in the chord was almost imperceptible and a few pins at such points brought the holes to almost perfect match.

For the erection of the two large spans a special erection calendar had been prepared in advance and manifolded, which prescribed to the men in the field the order of procedure and sequence of movements for each piece of the trusses when going into place. This feature contributed materially to the complete success of the erection without confusion and without accidents to the structure, in spite of interruptions by high water and some labor troubles.

Erection Features, Ohio Span

The erection on falsework was handled by a gantry traveler running outside of the trusses, in accordance with regular practice. There were certain special points in the work, however, apart from the distortion of the members of each triangle during erection in accordance with the general scheme already mentioned.

Since the floor had to be started at the Ohio end, where material was brought in, while the fixed shoe at the middle pier and the floorbeam there had to be set in true final position when that point was reached, it was necessary to provide against uncertainty in pier spacing and overrun of floor. With the long floor system supported on high and rather flexible towers through the middle, and on comparatively stiff towers at the two ends where the towers were braced to each other, it was uncertain whether expansion would cause the floor to creep sufficiently to prevent placing the floorbeam at the middle pier. For this reason the floor was first placed 6 in. nearer the Ohio end of the bridge than its final position.

The lower chord of the span was erected level and straight and all splices were riveted; then it was jacked to approximately the shape of a predetermined no-load camber curve, such as to connect the web members to the chord without further jacking the chord. This

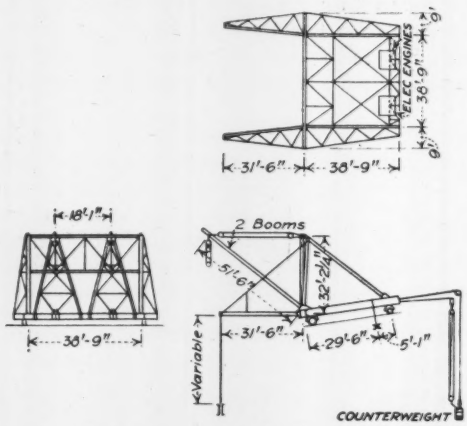


FIG. 13. CREEPER TRAVELER FOR CANTILEVER ERECTION OF THE KENTUCKY SPAN

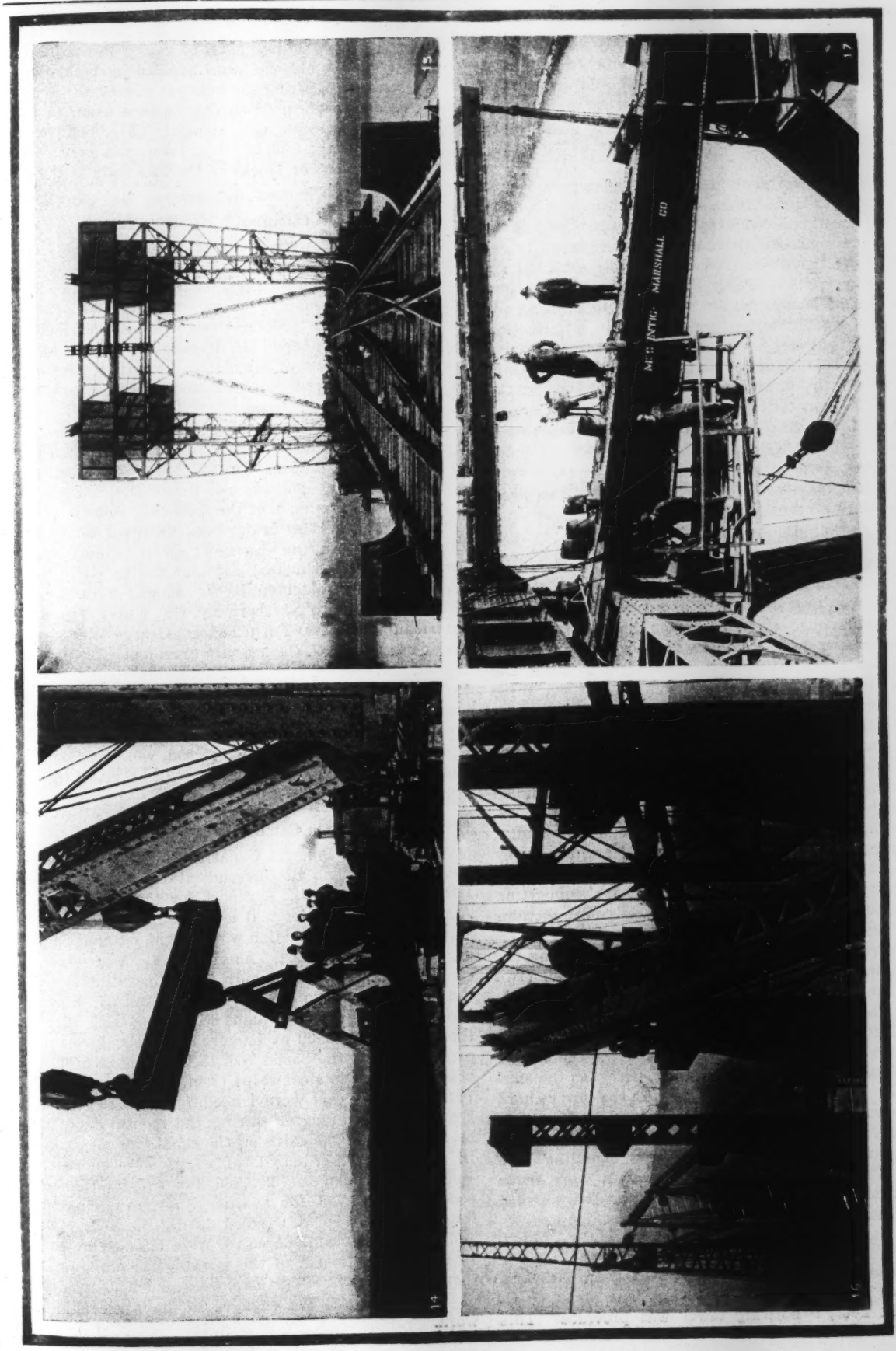
manner of riveting up the bottom chord eliminated the chief secondary stresses in this chord perfectly and simply. The method has been used previously in smaller bridges, but never in a long-span bridge. Virtually no time was lost through the operation, for while the lower chord was being riveted the gantry traveler was raised and the light posts and hangers of the truss were erected.

The Ohio span was left on the steel falsework until sufficient of the Kentucky cantilever had been erected to make the structure self-supporting. When this stage was reached, the Ohio end was jacked up 8¼ in. to its final level, releasing the span from its support on the steel falsework towers.

Kentucky Span Erection

The cantilever work of the Kentucky span was done by the regular top-chord or creeper-traveler method, with the important exception that two temporary supporting bents were provided, under panel points 8 and 4, respectively. These were bents that had previously been used under panel points 8 and 12 of the Ohio side. The maximum cantilever length therefore was 465 ft., instead of the full span length of 775 ft.

At the time the cantilever reached the first supporting bent, at panel point 8, the stress in top chord U14 U18



FIGS. 14 TO 17. SOME OF THE ERECTION EQUIPMENT USED AT SCOTTSVILLE

Fig. 14—Handling a heavy member with both booms of hoisting tower. Fig. 15—Gantry at half height for floor work. Fig. 16—Hitches provided on a diagonal for lifting in proper balance. Fig. 17—Under the creeper. Note falls for holding diagonal, and special platforms.

amounted to more than 18,000 lb. per sq.in.; had a longer cantilever projection been necessary, by not using temporary bents, considerably more steel would have been needed in the top and bottom chords and in the main web members of both spans near the middle pier, to take care of erection stresses. The temporary supports served also to reduce the deflection of the cantilever.

The span was jacked up at each of the temporary supports as soon as landed there. Since continuation of the cantilever erection beyond the first support would again increase the top-chord stresses, it was necessary to reduce the deflection at the second support in order to keep these stresses within proper limits. At the same time the amount of jacking at the supports had to be so adjusted that, with the erection continually progressing, the load on the steel bents would not become excessive (these bents being taken from the falsework of the Ohio side). Thus, the jacking problem involved keeping the loads on the temporary bents within safe limits, keeping the stresses in all bridge members safe, and keeping the Kentucky end sufficiently high for jack clearance under the end floor beam after completion of the cantilever. Temperature variation, wind effect and the like had to be considered as contributory factors.

Special Tools Required

The Ohio span was erected by the gantry traveler shown by sketch in Fig. 11 and by view in Figs. 12 and 15. This was first erected to about 60-ft. height and carried two special 80-ft. booms on the front end for erecting falsework, floor and lower chord. For erecting the trusses it was raised to its full height of about 150 ft. In this condition its equipment comprised three main falls of 50 tons capacity each, hung on the center line of either truss, and two sets of fleeting falls suspended over the center line of the bridge. All were operated by electric engines.

The creeper traveler (Figs. 13 and 17), which handled the cantilever work of the Kentucky span, a tool designed and built especially for the work of this bridge, was equipped with two booms, operated and swung by electric engines, and with a jacking bridge suspended from outriggers. This bridge served for supporting and jacking the free ends of the lower-chord sections before they were connected to the web members.

The varied jacking which had to be done during the erection was provided for by ten hydraulic jacks (two of 500 tons capacity and eight of 200 tons capacity), several 50-ton Norton jacks, and about 30 screw wedge jacks of 200 tons capacity. These were used partly in connection with the jacking yoke for making the hanger connections at the top chord (Fig. 8), partly on the steel falsework of the Ohio span for jacking the lower chord and the various panels during the truss erection, and partly in connection with special castings, grillages and bolsters under the end floorbeams for swinging both spans. These end floorbeams themselves were made about twice as heavy as necessary for the finished bridge, in order to provide for the jacking.

Hoisting Tower for Material

To raise material to the bridge deck from the yard, located at the Ohio end of the bridge and about 60 ft. below the floor, a hoisting tower was provided. This was a four-post braced steel tower 40 ft. square and 60 ft. high, with two 50-ton 50-ft. booms on two adjoining corner posts. A balance beam handled by both of the booms served for lifting the heaviest members. Special hooks or dogs were used on this balance beam to take hold of the 48-in. wide main members (Fig. 14). A 30-ft. radius from the foot of either boom was sufficient to place the members on trucks on the deck span at the end of the main bridge.

Miscellaneous Equipment

Special hitches were provided for lifting the heavy members, as shown in Fig. 16. These were always used in pairs. They consisted ordinarily of two channels or plates, a pin and a sheave on the pin. Cable loops on the load falls passing around these sheaves carried the weight of the members. On diagonals or chords of one panel length one set of hitches was bolted at the center of gravity and, where needed, another set was placed at the free end.

A large amount of special equipment in the way of bolsters under the bottom chord for jacking, special falls to connect main diagonals to the top chord (Fig. 17), riveting scaffolds, etc., was also provided.

Mention is here made of the following men connected with the work. The bridge was designed by Gustav Lindenthal, consulting engineer; O. H. Ammann was Mr. Lindenthal's principal assistant engineer and R. T. Robinson his resident engineer. It was built for the Chesapeake & Ohio Northern Ry. Co., Frank Trumbull, chairman of the board of directors, George W. Stevens, president, and M. J. Caples, vice president. It was fabricated and erected by the McClintic-Marshall Co., with Paul L. Wolfel chief engineer, S. P. Mitchell consulting engineer for the contractor, E. A. Gibbs manager of erection, and A. Toohey superintendent of erection.

Detailed description of the erection work on the Ohio and Kentucky spans, respectively, will be given in subsequent articles.

Panama Canal Forces Still Large

Although the Panama Canal is finished, it is by no means a fact that all Governmental activities on the Isthmus have ceased. A report for the one month of August, 1917, indicates that maintenance, operation and supplementary construction work on the isthmus engage a great number of men. As an indication of what the canal is doing, in that month 172 ships went through the canal, a tonnage of over 521,000, and 57 ships entered the ports of the isthmus without passing through the canal. Over 5500 passengers arrived and over 6200 passengers left the ports. Oil to the amount of 77,000 bbl. was issued to steamships from the canal tanks, and 70,000 tons of coal were landed for similar purposes. Excavation by dredging during the month shows that by no means all the earth on the canal has been moved. In August 379,517 cu.yd. of earth were moved for maintenance purposes, 293,766 for construction purposes, and 102,793 for auxiliary purposes, making a total of 776,076 cu.yd. handled during the 31 days. In addition to this, 817,066 cu.yd. were handled by steam shovels. A statement of the working force shows that there were 19,813 silver employees and 3461 gold employees, making 23,274 engaged in the whole isthmian work.

One Labor-Shortage Problem Solved—Women in Machine Shops a Success

Thousands of Women Are Doing Efficient Work on Machine Tools of Many Classes—Different Management Methods Are Found To Be Necessary—Piecework Rates Same as for Men but Time Rates Somewhat Lower

EXCELLENT success with women in machine shops was reported by many manufacturing concerns in an extended discussion held at the recent annual meeting of the American Society of Mechanical Engineers. Some of the concrns which reported their experience employ several thousands of women in machine operations that heretofore had been considered exclusively men's work. Operation of grinders, lathes, drill presses, milling machines, punch presses for parts of electrical equipment, is done very successfully by women.

Careful detailed instruction of the women workers is a vital essential. Almost equally important are: First, proper selection of the employees when hiring them; and, second, proper regard for various psychological peculiarities of women that call for special arrangement of work or special treatment.

The most nearly complete account of experience, which, however, does not cover the psychological factors and such questions as time of employment and rate of pay as well as do other contributions, was presented by John W. Upp, of the General Electric Co., Schenectady, N. Y. Parts of his paper are reproduced in the following paragraphs:

Women in the General Electric Shops

"We have found women under proper conditions and with proper training almost, if not quite, the equal of men. We have been much surprised at woman's strength and endurance and are now willing and ready to assign her to duties which were until recently assumed to be entirely beyond her ability. She is remarkably quick to learn. We have found, however, that it is necessary to recognize some fundamental difficulties if women are employed in these unusual occupations. In considering her ability to withstand successfully work in the factory, it should be remembered that she is not so strongly built as man, that she is not so tall, that her reach is not so great, that she cannot stand so long, that she is unsuitable for lifting and carrying of heavy weights, and that she must have a great many conveniences that men do not require. Stools or chairs are provided where possible, and short rest periods are found advantageous in many cases.

"Careful attention must be given to the character of the women employed, and more thorough investigation must be made of their references than in the case of men, for the employment of one undesirable woman will frequently destroy the usefulness of a large department. All the women working in any section must be acceptable to the other women, or resignations with or without explanation will be apt to take place rapidly.

"We also found early in our experience that women between the ages of 18 and 31 are more adaptable and learn more quickly than those who are younger or older. We had a smaller percentage of failures when our women employees came from the industrial walks of life, that is, from families in which the husband, brother or father was a mechanic. The women then understood many of the machine operations, particularly if they had a sewing machine at home or were familiar with modern household apparatus. If we drew our prospective employees from those walks in life where the men of the families were engaged as bookkeepers, clerks or in similar work, the women had to receive much more instruction and they were more easily discouraged.

"It has been necessary to supervise and inspect more closely the work turned out by the women than by our regular run of men employees, for few women have any conception of the importance of dimensions, or any judgment as to mechanical strength or requirements. But you can be sure that once a woman employee is taught how to use a gage or learns what constitutes satisfactory work, the good work produced in the afternoon will be exactly the same as that produced in the morning. The judgment which is frequently so disastrous on the part of our men employees will not enter into the work of the woman operative.

"We have found it very difficult to teach women the difference between a dull and a sharp cutting tool.

"More attention must be paid to the appearance of the manufacturing departments when women are employed, for women are much more susceptible to surroundings than men.

"Machines must be somewhat more carefully safeguarded if women are to operate them than if men were doing the work. In general, safety for women who wear proper shop clothes is provided by the same safeguards as for men, except that with wire guards it is necessary to make the mesh smaller so that the hair cannot get through, and to place the guards farther from the moving parts.

"In all classes of factory operations women are more attentive to their work than men. They are more prompt, observe factory regulations in a better manner, and, in general, are neater about their work, but we have not been able to impress them with the importance of being on hand every day. Our record of absences of women is, as a rule, about 20% greater than among men.

"It would appear, from our experience with thousands of women who have worked on the lighter machine-shop and assembly operations, that these women are always looking forward to the time when they can leave their industrial occupations and take care of a home of their own, and I do not believe that there will be any different condition after the war is over."

Psychological Factors Affecting Women's Work

While some reference to a few of the psychological peculiarities of female labor was made by Mr. Upp, a special discussion of them was given by C. B. Lord, of the Wagner Electric Mfg. Co., St. Louis, Mo. As

brought out in the following extracts, two notable features of his attitude are, first, extreme insistence on neatness and cleanliness, and second, rejection of the idea of the overall type of uniform. He said:

"Contentment in woman is not induced by allowing her too great liberty of action, but rather in laying down strict rules for her guidance. When she becomes habituated to these rules she accepts them as logical limitations and is content, provided always that they are just.

"Dissatisfaction with surroundings is a prolific cause of discontent. The same building, the same rough bench and the same work result in mental fatigue, and as this is cumulative a crisis is possible at any time, affecting maybe the individual only, perhaps the group or mass—trifles, perhaps, and yet irritation has caused more murders and excited more revolutions than has oppression; and so, cheerfulness is an important factor.

Temperament of Women Helpful

"The temperament of women makes them acutely sensitive to color, neatness and cleanliness. In harmony with this, all machines that are operated by girls are painted with a white oilproof enamel, not as a fad, but to promote cheerfulness. Our toilets are clean, not disinfectedly, but soap-and-water clean.

"No woman who is clothes-conscious is efficient, and any woman who is either not as well dressed as her neighbor, or is better dressed, is clothes-conscious. Therefore the obvious answer is uniformity of apparel. We have found the remedy by furnishing at cost an unfadeable blue chambray. I want to emphasize the *unfadeable*, for it is this that makes it successful. As the waist is the most in evidence we require a uniform waist and apron. The success of the uniform depends upon an absolute enforcement of the rule. Having in mind that they may want to go shopping on Saturday afternoon, we make it optional with them to wear uniform waists or not on Saturday.

"In some factories girls are wearing overalls, and I think it will be found that they, or the ones responsible for this decision, were rather masculine. The type lacks acute sex-consciousness, and looks a man straight in the eye, but unfortunately also has the masculine moral aggressiveness—or I might say a lack of feminine retirement—and constitutes the dangerous element in the shop.

Matter of Fatigue Considered

"In considering comfort and contentment we must bear in mind that fatigue can be caused by position, by improper form or height of seat, improper foot rests or lack of them, awkward fixtures, placing left-handed girls on right-handed machines, and other minor causes. These are all remedial troubles, but they cause girls to quit and foremen to discharge them.

"The question of pay is a perplexing problem, and one which must be settled locally. A woman is not as strong as a man, but is more dexterous; she has not the reasoning power of a man, but has a quicker mind. Where either of these attributes adds to her ability she should reap the advantage. Where piece rates are set they should apply equally to both sexes, but when I am asked, 'Should she receive equal hourly compensation with a man?' I must answer 'No,' but she should receive as much as or more than a good-sized boy."

Work of High Accuracy Produced After Proper Training

J. M. Bethel reported successful surface grinding and also some very difficult highly accurate cylindrical grinding done by women in the Taft-Pierce Mfg. Co. factory. Women there have not yet been put on screw-machine work, but the Worcester Pressed Steel Co. has been "exceedingly successful in using girls both on screw-machine work and on press work," according to J. W. Higgins. "Further," says Mr. Higgins:

"We are advocating now the forming of classes in our boys' trade school and girls' trade school for preliminary instruction of girls who have not worked in mills, in operations of inspection, gaging and assembling, and also to familiarize them with machine-shop methods and practice, especially with a view to their protecting themselves against accident, by teaching them the dangerous points of the machines, and also so that they may conserve their strength and not tire, and may develop themselves uniformly."

The Remington Arms-Union Metallic Cartridge Co., said F. E. Blake, is employing 1300 girls in its new rifle plant, which was organized and equipped for men exclusively. The women do milling, drilling, polishing, filing, inspecting and "all of the operations in the shop which do not require man's strength. In all those things we employ women to the very best advantage." The company employs well over 6000 women in all.

"At the Ross Rifle Factory in Quebec," said Mrs. H. E. Heustis, "there are three women experts in rifling. They set their own machines, grind their own cutters and give an output in quantity and quality as high as expert riflers. They are the first women on the continent of America to become riflers." In that factory machines of all classes are being operated by women.

Wage and Time Schedules Require Careful Study

As to wages, the general practice appears to be to pay women the same piece rates as men. E. J. Poole reported the use of a system that has been used successfully abroad, paying women "two-thirds of the wages of the men who are on that particular job. When they become proficient they get the full wages of the men. If it is piecework they get the same piecework rate that the man gets."

The time schedules are arranged in various interesting ways. At one plant, it was reported, the women work nine hours, while the standard for the men is ten hours. In some plants the starting time and quitting time are so set that the men and women do not arrive or leave together. The most individual system is in use at the Canadian Fairbanks-Morse Co., Ltd., Toronto, as reported by P. C. Brooks:

"In order to get continuous and sustained effort from the women, we arranged our work on a 6-hr. continuous basis, which is as long a period of time as anyone can work without stopping to eat or rest. There was no intermission between shifts and there was no general change of shifts at any hour. Each machine had its operating hours designated on the sign over the machine,

and the four women employees who worked during the 24 hours knew at what time they were to report to keep each machine going. This scheme was coupled with an arrangement at the time office for a reserve force of women, so that the machines were kept in operation at all times seven days a week.

"We gained a large advantage by not having the usual loss of time in a general change of shifts at a given hour. We had women coming in and going out every hour in the twenty-four. We employed about 1500 under these conditions. Over a certain period the number of women who were discharged or quit was just one-half the percentage of men who left our service under similar conditions.

"Our experience proved to us that we obtained 50% more general intelligence from women, more punctuality and loyalty, more consistent effort and less trifling; and as to quantity and quality of workmanship, after some experience and under the same conditions they were fully equal to men in every respect."

Rattler Test Called Unfair to Shallow Paving Brick

Experience, Says William C. Perkins, Indicates Need of Allowance To Correct Losses on Samples of Varying Depth to Common Basis—Large Spheres Too Severe

SINCE the use of monolithic and cement-sand bed construction has resulted in a demand from engineers for a brick 3 in. in depth but of the same surface measurement as the standard brick, the problem has arisen as to what allowance or differential shall be given this shallower brick when it is subjected to the rattler test, according to William C. Perkins, chief engineer, the Dunn Wire-Cut Lug Brick Co., in a paper presented before the recent meeting of the American Association for the Advancement of Science. Mr. Perkins said that the specifications for the rattler test distinctly state that some allowance must be given when bricks of other dimension than the standard are tested. Several authorities have given an arbitrary allowance; others have tested 12 and 13 bricks, but as yet no standard allowance has been determined. The practical testing of 3-in. brick gives no authentic data. Some 3-in. bricks have tested as well as the 4-in. brick of the same make and others have run poorer. There is no doubt that the liability of a 3-in. brick breaking in the rattler is greater than that of the 4-in. brick, and when this happens of course there are more edges under abrasion.

In the testing of brick in the rattler the two essentials in weighting the result of the test are the weight of the brick and the number of lineal inches of edges which are under abrasion—since the loss in the rattler is mainly due to the edges being worn or broken off. This loss varies with the form of the edges and corners of the brick. If a brick has square edges it will lose more in the rattler than one having rounded edges. This is especially true during the first 600 revolutions. Some paving engineers recognize this and allow a differential of from 1 to 2 per cent. in testing a standard wire-cut lug brick.

A standard 4-in. brick has 64 lin.in. of edges, while a standard 3-in. brick has 60 lin.in. of edge, or 6¼ per cent. less. Upon an examination of the bats of 3-in. and 4-in. brick after they have been rattled the center one inch of the 4-in. bat shows very little loss except at the edges. In other words, the bats show that the 3-in. and 4-in. brick will lose very nearly the same weight of material—the 3-in. brick possibly losing 6¼ per cent. less material on account of the abrasion on the edges of the middle inch of the 4-in. brick. Therefore, in comparing the two bricks we will not consider the square inches of surface under abrasion.

The two determining factors in the rattler test are undoubtedly the weight of the brick and the number of lineal inches under abrasion.

Let us assume that the specifications call for a 22 per cent. loss for a 4-in. brick. Then our factors are (1) ten 4-in. bricks, weighing 100 lb. and having 640 lin.in. of edges; (2) ten 3-in. bricks weighing 75 lb. and having 600 lin.in. of edges.

By compound proportion, remembering that the heavier the brick the better the test, and the more lineal inches of edges the poorer the test, we have:

$$\begin{matrix} 75 : 100 \\ 640 : 600 \end{matrix} :: 22 : X$$

Solving this we find X equals 27½ per cent., which would be the theoretical permissible loss of a 3-in. brick under a 22 per cent. specification for a 4-in. brick.

This can be checked by putting in the rattler 100 lb. of 3-in. bricks and eliminating the weight factor, thus: (1) Ten 4-in. bricks weighing 100 lb. and having 640 lin.ft. of edges; (2) 13⅓ three-inch bricks weighing 100 lb. and having 800 lin.in. of edges. The proportion would then be:

$$640 : 800 :: 22 : X$$

Solving for X we find 27½ per cent., the same as in the first proportion.

The City of Baltimore has used a considerable number of 3-in. brick. A report made by Frank A. Duncan, principal assistant engineer to Maj. R. Keith Compton, chairman of the Paving Commission, contained the following statement:

"I beg to submit herewith my investigation as to the allowance that should be made in testing the paving bricks 3 in. in depth. . . . In order to determine this I took a standard ..... brick, which is 3½ in. wide, 4 in. deep and 8½ in. long, getting its cubical contents and its weight, and then selecting a tested ..... brick, showing a uniform loss, and which I found to be 18%. My idea was to determine the loss of the 1 in. in depth, which is eliminated when we test a 3-in. brick. This 1-in. strip must be considered as coming out of the center of the 4-in. brick. This is so because the wearing on the corners and edges are similar in a 4-in. and 3-in. brick. I found that the loss of the 1-in. strip when tested in the 4-in. brick was 7.3 per cent. of its own volume. The total brick is represented as 100 per cent. and the 1-in. strip as 25 per cent. of the total volume of the brick.

Therefore, a loss of 7.3 per cent. on 25 per cent. of the brick is equal to a proportionate loss of 1.8 per cent. on 100 per cent. or the brick itself; and the total loss on the brick being 18 per cent., 1.8 per cent. would be 10 per cent. of the total loss. In other words the 1-in. strip would lose 10 per cent. of the total loss of the whole brick."

This investigation considers the surface abrasion on the middle inch as well as the abrasion of the edges, and Mr. Duncan states in this instance it was 10 per cent. of the total loss. This is an inviting field for further investigation.

Let us assume that ten 4-in. brick, weighing 100 lb., lose 22 lb. when rattled. Now, if the middle inch loses 10 per cent. of the total loss, then theoretically ten 3-in. bricks should lose 19.8 lb., but as these brick only weigh 75 lb., this would mean a 26.4 per cent. loss, although in reality they lost less weight of material than did the ten 4-in. brick. It is, therefore, offered for the consideration of engineers that instead of specifying in "per cent. of loss" that they specify the maximum "loss in pounds" which ten bricks shall suffer in the rattler. This would eliminate the element of weight, and the rattler test as written in the specifications would apply to all depths of standard brick, no matter whether the bricks are 5 in., 4 in. or 3 in. in depth.

Are the Large Spheres Warranted?

Some engineers believe that the use of large spheres, weighing 7½ lb. each and heavier than the average weight of the individual 3-in. brick, is prejudicial in the rattler, as results may be obtained which are accidental. For instance, if a brick becomes bridged in the rattler and is struck in the center with a large shot, it is likely to break even though it may have no structural weakness. Every broken brick means more edges under abrasion and causes a variation in the results. A more uniform test might result if we replaced the large spheres by 75 lb. of the small spheres—thus using the same weight of charge but having all small spheres.

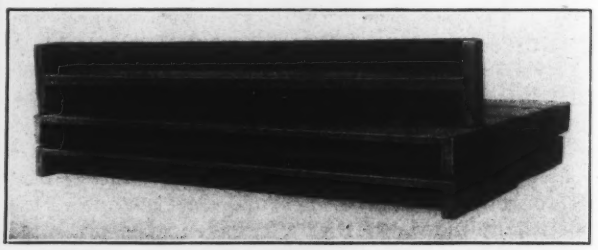
In April, 1916, the Bureau of Tests of the State Highway Department of New York made a series of tests on wire-cut lug brick using (1) the standard charge, (2) 300 lb. of small shot only, (3) the large shot only. In these tests the bricks were weighed at the end of every 100 revolutions, the percentage loss determined, and the results plotted. The curve representing the percentage loss due to the charge of small shot is much more uniform than the curves when the other charges were employed.

At the present time the Paving Commission of the City of Baltimore in testing 3-in. bricks use 10 bricks, replace the weight of the large spheres by small ones and allow an additional loss of 1½ per cent. to their standard loss of 22 per cent. for 4-in. brick.

While it has been suggested that in testing 3-in. brick the large spheres be reduced in size so as to be able to obtain a uniform comparison of the tests between 3-in. and 4-in. brick, personally I believe that if the large spheres are discarded and only a charge of 300 lb. of small spheres is used, a more uniform test of the brick will be obtained. But there is no doubt that a differential must be allowed a 3-in. brick over the permissible loss for a 4-in. brick. How much to allow is the question. Theory indicates a certain allowance. Practical tests show a variation. Some advise the elimination of the large shot and a calculated allowance. From present data why may we not specify the permissible maximum loss in weight of abrased material, or compromise, perhaps, on a differential of 4 per cent. above the specified per cent. loss of a 4-in. brick?

Long-Span Precast Gypsum Roof Tile

SOME extra-length gypsum roof tile has been made by the Austin Co., of Cleveland, for the automobile factory which it erected for the Nordyke & Marmon Co. at Indianapolis, and on part of a munitions plant for the New York Air Brake Co. at Watertown, N. Y. These tile are distinctive mainly on account of their length. Shorter tile of the same type have been used in a number of buildings, but so far as the records show this is the longest precast gypsum tile used for this purpose. Each one of the tile is 10 ft. long, and is laid between purlins spaced at a distance center to center. The tiles are in T-beam section, reinforced in stem and flange, and provided with transverse ribs at the end.



PRECAST GYPSUM ROOF TILE ARE 10 FEET LONG

Progress on the Hetch Hetchy Development

The 59 miles of railroad grade in Hetch Hetchy Valley is virtually completed and has track laid upon it, so that, including the nine miles of grade previously constructed, the city now has a 68-mile line in operation, according to a recent report of M. M. O'Shaughnessy, city engineer of San Francisco. About 13 miles of the lower end of the line is ballasted with gravel, leaving about 55 miles still requiring ballast. A telephone line has been built along the line of the railway, and water tanks and other accessories for operation of the line are also provided. Two locomotives and a number of gasoline cars are now operated over the line, in connection with the work of finishing up the details of the railway project.

Four thousand feet of concrete lining for the power canal aqueduct at Early intake have been completed, leaving about 3000 ft. yet to be done. Waterwheels and generators are installed in the power house at Early intake, so that with the completion of the aqueduct and the connecting pipe the city's power plan for construction purposes will be available. This will amount to 4000 hp., installed in three units. Some work has been done in extending the openings on the main aqueduct from Early intake to Priest, 19 miles. The power pole line is being built along this route, so that by the time the canal is completed it is hoped it will be possible to distribute power along the line for construction purposes.

Traveling Towers Place 92,000 Yards of Concrete

Stationary Measuring Plants on Large Steel Mill Work Cut Labor Costs—Handling of Heavy Yardage Worked in with Footing Construction

COMBINING the operating economy of movable spouting plants with that of well-arranged stationary measuring plants, the contractor for the Trumbull Steel Co.'s mill extensions at Warren, Ohio, placed 65,000 yd. of concrete between Mar. 6 last and Oct. 15, with a considerable economy of labor. The traveling plants were used to complete one group of foundations, and were moved to place the second group while the steel was being erected and the fill placed at the first. After the second group was begun an extension to the openhearth furnace building in the first was decided on, necessitating the use of a stationary concrete spouting plant. About 92,000 yd. of concrete, 12,500 tons of steel and 800,000 yd. of fill are required, and the new plant is already in partial use nine months after starting work; yet so efficiently was the labor handled that the total force has not risen above 1000 men, and the excavation and concrete work have been accomplished with a force varying from 150 to 325 men.

MEASURING PLANT AT RIGHT AND TRAVELING TOWERS AT LEFT ARE SHOWN OPERATING IN SECOND LOCATION

The chief buildings to be constructed include, from west to east, a stock house, a producer gas plant with a filtration plant at its south end, a row of openhearth furnaces, and the blooming-mill building, which is the largest of the group and in the footings for which is a third or more of the concrete yardage. All the buildings extend with their long axis north and south, and the track system for the traveling towers and for the distribution of material consequently took the same direction.

A start was made with one tower on a track between the stock house and the producer gas plant, and the second tower on a track just west of the open-hearth building. Both were supplied with materials by a measuring plant at the base of a Y south of the producer gas plant and almost in line with it. This work finished, the measuring plant was moved over to a point south of the blooming-mill group and in line with its long axis. A second measuring plant was erected west of the center of this group, just at the northeast corner of the open-hearth building. Both traveling towers were transferred without dismantling to a new track along the west side of the blooming-mill group.

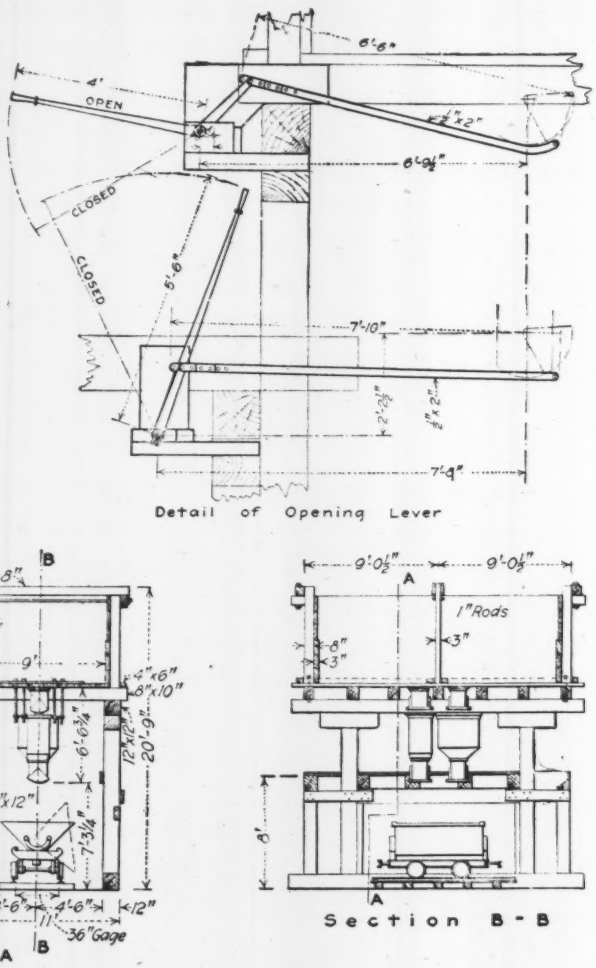
After this plant was all in operation at the second location, it was decided to extend the open-hearth building by adding about 50 per cent. to the north end. It was found to be more economical to set up a new plant than to attempt to use the ones engaged on the blooming mills and soaking pits. Accordingly a stationary mixing plant and tower were set up just south of the second measuring plant, and used, with a distributing tower in the center of the footing area, to concrete the extension.

The site is in a bend of the Mahoning River, which runs to the east of the new plant, separating it from the old. The river doubles back to the north, however, and this entire loop is to be cut off by constructing a new channel from a point below the pump house to the north of the new plant across the ¾-mile neck of land to the other side of the bend. This will throw the two portions of the Trumbull Co.'s plant together. In addition to the river, an old canal runs along the west side of the plant. This canal, which has not been used for years, is cut into many sections by fills for highways, railroads and other purposes. The section next the plant is such a pond and was used at first by the contractor as a source of water. It developed, however, that it was not fed by any considerable springs, and the section was pumped dry early in the summer, making it necessary to establish a new pumping station on the Mahoning River. As shown in the photographs, the land between the canal and the river is low and wet and subject to the flood waters of the Mahoning River, on account of which it was decided to raise the entire site by filling with granulated slag. This work was undertaken by the steel company, which obtained the slag from adjacent mills and which has employed a

force of about 500 men in bringing this in by rail, dumping it and distributing it. At some places 25 ft. of fill is required, as is shown by the height of the concrete piers under the buildings in the photographs. The concrete towers worked on the original ground surface before the fill was placed.

In spite of the fact that the original ground at the site was low and wet, it consisted of clay which furnished good footings everywhere except at the extension for the openhearth plant, where 700 thirty-foot Raymond concrete piles were driven in two weeks. The excavation for the footings was made with locomotive cranes, that for the openhearth and soaking pits not requiring sheeting. Some of the excavations, as under the blooming mills, were quite large. About 30,000 yd. were taken out altogether, and incorporated with the slag fill. Most of the slag fill was made by railroad methods, dumping from cars and raising tracks. At some points it was possible to unload the cars with a grab-bucket handled by a locomotive crane, and fill in around the footings. The openhearth plant, however, was too wide for this, and consequently the approach trestle of concrete and steel which leads up to it was concreted and used to bring in slag after the footings of the building had been finished. Two locomotive cranes, one of the steel company's and one belonging to the contractor, were used on the excavation on fill work.

The measuring plants referred to as supplying dry batches for the traveling mixer plants have been operated with extraordinary accuracy. When 65,143 yd. of concrete, form measurement, had been placed, the tally of the batches kept at these measuring plants indicated a total yardage of 65,339, about $\frac{3}{10}$ of 1% out of the way.



ONE MAN HANDLED ALL OPERATING LEVERS FOR CHARGING CARS WITH MEASURED BATCHES

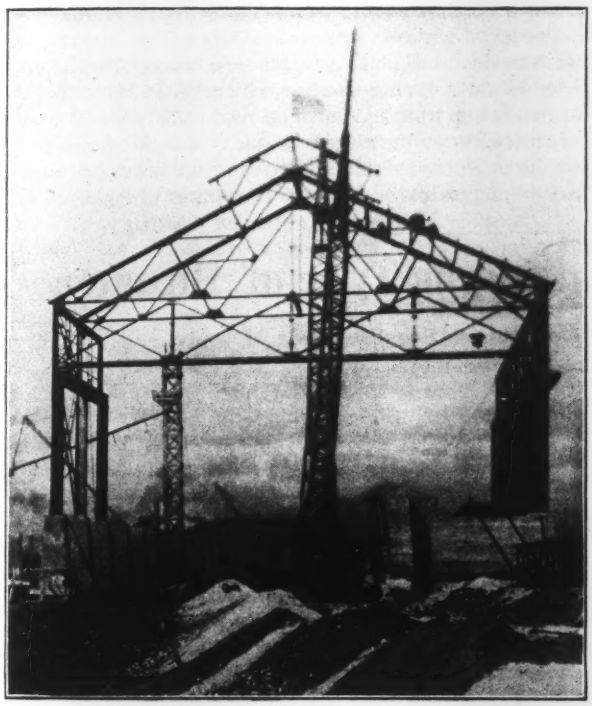
These plants are like a well-arranged gravity charging plant, except that the batches are dumped into cars instead of being dumped into the drum of a mixer. Sand and gravel are received in hopper-bottom cars, which are dumped through a trestle at each measuring plant. The track to these trestles at each location could be arranged so that cars could be dropped down by gravity, the loads from the tail track kicking the empties off the trestle. The tail track in each case holds eight cars, while the capacity of the measuring plant is about 16 cars a day. This made it possible to run with two shifts a day. From the stock pile under the trestle the material is handled by a "whirler" with a grab-bucket to the large bins over the hoppers. There are two sets of these hoppers, discharge and measuring, one above the other, for both sand and gravel. The measuring hoppers are below; one of them is drawn full of sand and one full of gravel by means of levers which open the discharge hopper gates. Both of these are discharged simultaneously into the dump car, where the cement is added. While this batch is being discharged into the car on the narrow-gage track beneath the bins the upper discharge hoppers are again being loaded. The levers are all within reach of one man, who is easily able to measure the materials and load the cars.

The cement is handled from the box cars on a track at the opposite side of the plant from the gravel storage, by a small belt conveyor swung through the door of the car. The cement handling requires almost as much labor as is used in operating all the rest of the plant, two men being required in the box cars, two receiving and two opening and dumping sacks into the dump cars and taking care of the empty sacks. Besides the seven men already mentioned and the foreman of each measuring plant, there are a hoisting engineer and fireman on the "whirler," two men on the receiving trestle shifting and dumping cars, and one switchman on the narrow-gage track helping to switch the industrial trains. These pass at the measuring plant, at the traveling mixing plants and on very long hauls at an intermediate siding.

On long hauls a train consists of a Plymouth gasoline locomotive and six 1-yd. dump cars, two trains being run for a single tower and the crew of each consisting of an engineer and switchman. This equipment

is sufficient to provide a continuous supply of batches to the mixing plant on a 1500-ft. haul. When the haul is shorter a reduction is made by cutting off one to three cars from each train rather than by attempting operation with one train. This is done because it results in a steadier supply to the mixing plants, and because a better organization can be kept up than if one of the train crews were laid off every time the haul shortened a little.

Each of these measuring plants and each set of trains is able to supply 50 to 60 one-yard batches an



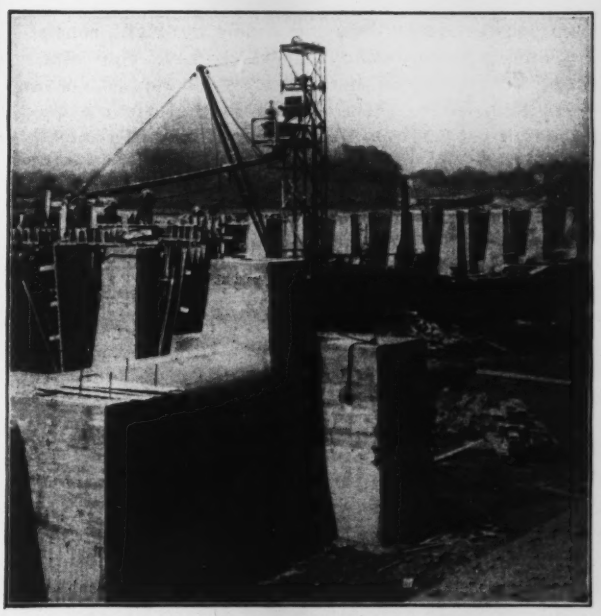
ROOF TRUSSES ARE SET WHOLE

hour, which is well up to the capacity of the mixing plants. However, the average output is, of course, limited to less than this by working conditions. It has been found possible to keep on hand in bins, and on the ground within reach of the whirler at each plant, 100 cars of sand and 200 cars of gravel, while the cement house at each measuring plant contains a reserve of 12 cars. This stock, representing about a week's run, has been necessary on account of the railway situation, the concrete materials arriving by rail from Pittsburgh.

The traveling mixer plants, equipped with 1-yd. mixers, are like those used by the same contractor on the work of the Bethlehem Steel Co. at Sparrow's Point, Md., described in *Engineering News-Record* of May 24, p. 385. The mixers used are side loaders, and the charging skips are let down into shallow pits built alongside the track so that the side-dump cars can turn over into them. Each of the plants in use at Warren has an 80-ft. wood tower. There is a foreman for each plant, an engineer on the hoist and another on the mixer. There are also a fireman and a man aloft at the hopper on the tower, while two men dump the cars into the loading skip. Only a small crew of four or five men is required in the forms. Thus the maximum force on concrete work number but two foremen and 29 men for each plant, or a total of 62 men for both, with which all of the materials have been handled, transported, mixed and placed for the bulk of the 65,000 yd. of concrete placed up to October.

In working on the large reinforced-concrete mats required under the soaking pits, the soaking pit producers and the openhearth extension, these plants were able to reach a capacity per tower of 350 to 400 yd. in 10 hours, but in pouring pier forms, some of which were 30 ft. high, progress was limited by the strength of the forms to a much smaller yardage. A 1:3:5 concrete has been used throughout.

In addition to the two traveling plants which have handled the bulk of the work so far, the stationary plant referred to, which has been erected for completing the openhearth building foundations, also contains a 1-yd. mixer, over which are charging bins supplied with materials by a "whirler" at the location of the third measuring plant shown on the plan. The same trackage and unloading trestle were used for the stationary plant as for the adjoining measuring plant. A 100-ft. steel tower was erected to take care of all work in the extension, the farther side of which is being concreted with the aid of a 69-ft. wood tower put up at the center of the building and equipped with a distributing hopper and chutes. There is also in use at the work a mixing plant with a ½-yd. machine and a 20-ft. tower mounted on a gondola car and supplied with materials by wheelbarrows from cars coupled in



TRACK PLANT FOR SMALL WORK; SEWER IN FOREGROUND

a train. This track plant has been used for odd jobs, the largest of which was a small filter plant at the south end of the producer gas plant, which required 1100 yd. of concrete, and which was decided on after the large traveling plants had been moved.

Virtually all of the concrete work required is for

the group of buildings outlined above. The work also includes a good deal of standard building construction. Little concrete work was required for these structures, however, the main pumping plant near the river being typical. This is a steel-frame brick-walled building, the foundation excavation for which was made in a wood-sheeted cofferdam. The concrete required was mixed at a plant erected at the site. There are also two large arch concrete sewers located one on each side of the open-hearth plant and extending north from the new plant to the river. They were built in 100-ft. sections with traveling steel inside forms designed and constructed by the contractor.

Following the footing work the steel erection was promptly started. It is estimated that about 12,500 tons of structural steel will be required for the main group of buildings. The erection work is being handled with locomotive cranes, two with long booms being used to put up the steel, and two ordinary cranes to handle it at the receiving tracks. The practice is to rivet together on the ground trusses and similar members until the assembly to be set reaches the capacity of the cranes. In this way most of the roof trusses have been put together complete and raised to place between the two cranes. The use of this method has eliminated a great deal of time-consuming handling of smaller pieces to lofty locations with the cranes.

The entire extension for the Trumbull Steel Co. was designed by the Alex. Laughlin Co., which is supervising its construction. All of the concrete and foundation work and the channel change of the Mahoning River are being done by the Dravo Contracting Co., for which Harry Shaeffer is superintendent and William H. Fowler assistant superintendent. The structural steel was designed and is being erected by the Riter-Conley Manufacturing Co., for which W. P. Boggs is in charge at the work. As mentioned, the general slag fill required is being placed by the Trumbull Steel Co., with the exception of the fill for the foundations proper, which is placed by the Dravo Contracting Company.

Condition of Road Surface Outweighs Type of Bitumen

Other Details Secondary in Importance—Surface Tension Suggested as a Measure of Value—Alternate Freezing and Thawing Worst Enemy

ABOUT ten years ago the dual problem of dust prevention and road preservation—to borrow the commonly used terms—first assumed importance. A large mileage of hard-surfaced roads which had been built and maintained according to varying ideas and methods, was threatened with destruction; and a variety of bituminous products, differing widely in origin, consistency and behavior—many of which have now disappeared entirely from the market—was applied in the efforts to preserve them. Prior to that time a good macadam road had been defined as one having a smooth, hard surface, furnishing a water-tight roof for the earth subgrade beneath and acting as a "more or less rigid stratum to distribute the concentrated pressure of wheel loads"—in other words, a foundation and wearing surface in one. In this description, however, were included many roads which were in no wise suited to carry successfully a bituminous surface treatment, according to Julius Adler, engineer of tests, from whose paper before the American Association for the Advancement of Science the following matter has been taken.

The present day macadam road in addition must present a suitable surface for the application of a liquid bituminous material. For the latter purpose there is fairly general agreement as to the necessity for a clean mosaic surface, with a maximum exposed area of tightly locked, coarse road metal and the least possible part of the surface occupied or covered by fine material. If a graded aggregate has been used it is essential that the distribution of the different sizes shall be uniform, the smaller pieces locking the larger pieces and reducing the size of the individual surface voids; and that there shall be a complete absence of "pockets" of small sizes. If this result is accomplished the bitumen will have a direct anchorage to the surfaces of pieces of solidly embedded road metal, and the gaps between the individual pieces will be of the least practicable size. It may be said that it is now an established fact that the success of bituminous surface treatments is far more dependent upon the condition of the roadway treated than upon the kind of bituminous material used or any other details in the process of application.

It appears that a greater and desirable degree of uniformity of practice will be reached only by more careful inquiry into the real purposes of bituminous surface treatments which may lead to a more general agreement among engineers as to general types, materials and methods to be employed to meet similar sets of conditions. Bituminous surface treatments at first appear to serve a number of distinct purposes in the preservation of the road surface, but upon analysis these may be placed into two classes: (a) Priming and binding the upper portion of the road crust, (b) sealing and smoothing the road surface.

The fine material occupying the voids must be saturated by the bituminous material so that the particles will adhere to one another as well as to the contact surfaces of the adjacent road metal. This should result in the formation of an irregular, but continuous layer which will serve to intercept water from the subgrade. Contrasted with this the sealing action forms a continuous film of bitumen or bitumen-coated particles on the exposed surfaces of the upper layer of road metal, and filling the gaps between the individual pieces of the latter. This seal coat, so long as it remains intact, serves to waterproof the road surface and tends to produce a generally smooth and slightly resilient surface, lowering tractive resistance, reducing the abrasive and picking action of horse-drawn traffic, and offering more effective resistance to the shearing and displacing action of motor-driven traffic.

In the selection of the proper material these two functions should be weighed according to the necessities of the case. Roads receiving their first treatment un-

doubtedly require the priming action above described. Contrary to the practice of some localities, this would seem to limit first application materials to those which are liquid at normal air temperature. The full range of products which can be applied successfully for this purpose is not yet known, but in a given case the selection of the particular material to be used should undoubtedly be influenced by the question of how soon the priming coat will be followed by the seal coat. It is obvious that a more heavily bodied material is required if several months are allowed to elapse. On the other hand, it cannot safely be assumed that all bituminous materials—regardless of character or origin—are necessarily of the same value as primers simply because they are of approximately the same liquid consistency. Observation and experience have taught that there is a considerable difference in behavior in this respect, and while no specifications as yet attempt to cover definitely this particular point, it has been suggested that a study of the surface tension of different products of about the same consistency be made, since this property is a measure of its ability to creep down into the irregularities between the fine particles of mineral matter in a road surface.

Bitumen Should not Thicken too Rapidly

In this same connection it should be remembered that just as the usual "hot application" bituminous material is liquid only so long as it retains its heat, similarly many products which are liquid at normal temperature may remain so only so long as they retain their volatile constituents. If the latter are lost too quickly, the bituminous material will thicken so rapidly as to fail to serve its purpose as a primer. If, as is frequently the case, a bituminous material for first application must serve not only as a primer, but also provide sufficient surface sealing so that the road may safely carry a season's traffic, the most desirable product is that which is so constituted that, while not changing in consistency too rapidly upon exposure to the air, it will nevertheless leave a residue of heavier consistency on the road surface to serve as a cementing material for a partial seal coat.

Considering the second case, if the bituminous material is to serve almost entirely in the production or maintenance of a seal coat, the character of the residual bituminous material finally left on the road surface is the most important factor to be considered. In so far as consistency at the time of application is concerned, the necessity for a material that is liquid at ordinary air temperature is largely removed, since no priming or penetrating qualities are required. There is, however, a greater assurance of a complete union between the old and newly applied material, and of an enlivening of the former (in the case of roads which have been treated in previous seasons) with the use of this class of material. If a liquid material is to be used for this purpose it becomes quite important from the standpoint of the convenience of the traveling public that it should contain a considerable percentage of volatile material, since a product of the reverse character, placed and held on the surface of a fairly impervious road, creates a slippery and unsafe condition which requires excessive time for correction because of its slow volatilization. These considerations indicate that a given liquid bituminous product can hardly be equally suitable for use both as a priming and a sealing material. Whether a hot or cold application material is used in seal coat or retreatment work, the essential point is that the original bituminous material, or the final residue from it, shall be of the proper consistency, pliable and elastic, and retain these properties under temperature changes, aging and exposure to traffic and atmospheric agencies.

The influence of the character or quality of the road metal on the success of bituminous surface treatments is still an uncertain factor. Material of an argillaceous character has been noted to affect the results adversely. This may be due to the presence of earthy material in the screenings, or to the smooth surfaces of some of these rocks. Hard, crystalline, metamorphic rocks are difficult to bond with their own screenings and are slow in forming a solid, impervious crust. The road surface frequently ravels in spots under traffic before the first bituminous application is made, thus interfering with the complete success of the treatment. Occcasional instances have also been noted of stone so soft as to be crushed by the weight of traffic beneath the bituminous seal, causing a local breaking up of the bituminous seal. In general, however, the requirements for stone for surfaces intended to receive bituminous treatments are less exacting than in the case of waterbound macadam.

It is evident that the life and completeness of the bituminous seal depends directly upon the ability of the underlying road crust to furnish support. Surface treatments for at least the first few years of their application can scarcely be regarded as more than films. However perfect or elastic this film may be, it is questionable, in view of its small depth, whether it can reasonably be expected to withstand the pounding of the hoofs and wheels of heavy horse-drawn traffic or the shearing action of heavily laden solid-tired trucks—especially when acting in the presence of a coating of mud, or melting snow or ice, on the road surface. Excellent examples of bituminous surfaces in suburban sections of cities in which a real estate development unexpectedly begins have been seen to deteriorate rapidly; while on the other hand inferior roads in localities where the surface is blanketed with snow or ice, which remains from the early part of the winter to the final spring thaw, are found to be in excellent condition.

Because of the uncertainty of changes in the amount and character of traffic, as well as temporary severe increases resulting from a condition such as previously mentioned, it will always be difficult to define the exact localities in which bituminous surface treated roads can be relied upon to meet all requirements. On the other hand, systematically maintained bituminous treated roads have been found to be an entire success under the conditions for which they were originally designed—that is, for large amounts of motor traffic.

Frost an Important Factor

All bituminous materials will deteriorate to some degree on exposure to the air and weather. Well-drained macadam road crusts having a complete bituminous seal have been found to contain a very appreciable amount of moisture during the early spring, drawn undoubtedly from the subgrade and adjacent earth shoulders. Under

freezing temperature this moisture in the body of the road does more damage to bituminous surface films than any other natural agency—especially in the case of roads which, as a result of careless construction, etc., do not conform to some of the requirements previously described. As a further illustration of the importance of frost action, it is reported that in extreme Southern states it is possible to maintain bituminous treated gravel roads as a permanent form of construction, in so far as this type can be called permanent; while in certain New England states, even with careful attention to drainage, it is found impossible to hold the impervious bituminous surface on gravel roads subjected to the heaving and consequent settling of the spring break-up.

Assuming that traffic and climatic conditions are reasonably favorable to this class of work, it still remains to be determined what are its further limitations. Improved methods of construction, more attention to details in the construction of the road, and better selection and application of bituminous materials, may to some degree widen even its present range of usefulness. Repeated annual treatments, however, introduce problems which are not yet entirely solved. More or less heavy, unstable carpets of bituminous material produced during some of the early stages of this work proved entirely unsuccessful. Successive applications (varying very considerably with the kinds of material used and the nature of the traffic over the road) show indications of producing a similar condition, only modified by the facts that the general character of the materials in use is now more suitable than some of the early ones, and that the production of a carpet by a succession of thin layers thoroughly united, and having good adhesion to the surface beneath, is more apt to produce a stable combination. On the other hand, attempts to resurface old macadam roads with bituminous concrete mixtures, even where the mineral aggregate is scientifically graded and the bitumen of selected consistency and quality, have been found not to meet with unfailing success, and there is apparently no good reason to expect superior results from the type of construction under discussion.

From an economical standpoint, it may under some conditions be demonstrated that there is a possible saving in the construction, or more frequently the resurfacing, of an existing macadam road, if maintained by systematic surface treatments, as compared with the construction of one of the higher priced and socalled permanent types of surfaces. Generally speaking, however, it will be found that the combined cost of an annual bituminous treatment with the caretaker or patrol system, totaling from $500 to as high as $1000 per mile of 16-ft. roadway, represents an annual charge in excess of the maintenance, interest on the difference in first cost, and depreciation on a road of greater initial cost. Consequently, the most apparent recommendation for the bituminous treated road lies in its relatively low first cost which makes possible a larger total mileage with the same outlay.

Efficiency of Storm-Water Sewers Depends on Inlets

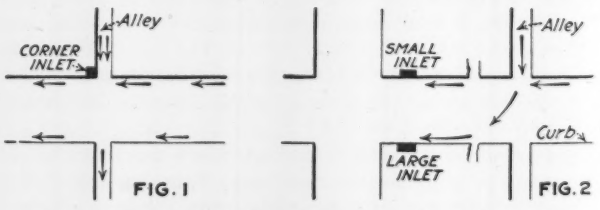
Type, Location, and Adjacent Paving Should Suit Conditions of Each Case—Alley Inlet Problems

By Irving P. Kane
Assistant District Engineer, International Joint Commission, Gittings, Md.

Vast sums are expended each year in building storm-water sewers large enough to carry an assumed run-off, while the inlets are not correctly designed nor built to deliver this amount to the sewers. Many cases have come under my observation, where during heavy storms, the sewer being far from full, in that immediate vicinity flooding took place due to faulty inlets. Some of the trouble was caused by the paving department failing to pave properly around these inlets, but much of it was due to giving only minor consideration to the question of inlets. In many cases standard inlets were selected and located in the office, without careful study being given to the ground and other peculiarities of each individual case.

To fulfill properly their functions the inlets should be able to collect all or most of the water which will reach them at the time of the maximum run-off for which the sewer is designed, and they should so collect this water that it will inconvenience the pedestrians as little as possible. To accomplish this requires properly designed and located inlets and coöperation by the paving department. Inlets alone cannot always do the work; the paving around them must be correctly dished and banked in order to change the direction of the water flowing on the street and divert it into the inlet.

While inconspicuous inlets are to be desired this feature should not be insisted upon to such an extent as to impair their efficiency. In order to render inlets as inconspicuous as possible recourse is often made to the horizontal grating type. During light rains, and provided the streets are kept clean of paper, leaves, etc., these do collect the water, but during the rain for which the sewer is designed they seldom do. This is especially true on streets which have many trees and in the poorer sections of cities where there is much litter. Leaves and paper form a mat on the grating which impairs the efficiency of the inlets or makes it useless. On heavy grades the water moves so rapidly that much of it passes over or around the inlets unless these are properly designed and located and particular care is given to the nearby paving. The paving is subject to hasty deterioration due to traffic passing on the grating. The horizontal grating type of inlet finds its greatest usefulness in cities having a combined sewerage sys-



PARTICULAR CARE SHOULD BE TAKEN IN LOCATING STORM-WATER INLETS AT ALLEY AND STREET INTERSECTIONS

tem where the down spouts are connected directly with the sewer, so that the amount of water on the street is not large.

At locations where a large amount of water is to be expected inlets which have a large opening through the curb should be built, the length of opening varying with the amount of water and grade of the street. Here the paving is of utmost importance also. If the street is paved past the inlet opening, as if the inlet were not there, as is too often the case, then this inlet is almost useless. The water will flow rapidly down the street in a wide stream, and unless the paving is dished sufficiently far out from the curb and a bank built at the lower end of the inlet, the water will not be diverted into it. It should be noted that the flatter the crown the wider will be the stream of water.

The grade of the street must influence the size of the inlet opening. Larger and more inlets will be required in proportion to the heaviness of the grade, as the rapidly moving water is difficult to divert into the inlet. On heavy grades with a separate system it will probably be found impracticable so to pave around the inlets as to divert all the water; therefore additional inlets should be installed near the foot of the hill to collect the overflow from those above.

Corner Inlets Often Advantageous

Corner inlets are often found advantageous, since one such will do the work of two side inlets, when the amount of water tributary to this point is not too large. The chief disadvantages of the corner inlets are (1) the water must pass the cross walk before reaching the inlet, thereby greatly inconveniencing the pedestrians; (2) the liability of their being broken by trucks or heavy wagons hitting them. The latter danger can in a large measure be overcome by the use of cast-iron covers.

In approaching a corner inlet from two directions, where the grade of the street is heavy, the water coming at right angles and at a high velocity tends to force itself away from the inlet, so an exceedingly heavy bank is required to force this water back into the inlet. This sometimes makes a dangerous condition for traffic.

Inlets At Street and Alley Intersections

In streets with alleys, usually most of the water which falls on a block is drained back to the alley and from there it flows to the street, so that as a rule it is best to catch this water at the intersection of the alley and the street, thus preventing it from reaching street intersections. If most of it is caught at the alley, then smaller and less conspicuous inlets can be installed at the street intersections. Large inlets are less conspicuous in the alleys, and traffic there is light, so the paving department will object less to proper paving. On heavy grades there is an excellent opportunity to use a corner inlet to full advantage by placing it on the down-hill corner of the alley facing up the street. The water coming down the street flows straight in and will help turn that which comes from the alley (Fig. 1). If the water is not caught here, when the grade of the alley is steep and the crown of the street is flat the water leaving the alley at a high velocity will not turn the corner but will pass over the low crown to the other side of the street (Fig. 2) necessitating a large inlet on the low side of the street at the intersection and a small one on the high side.

To sum up, the inlets should receive more attention than is ordinarily given to them. Each inlet location should be studied on the ground. No fixed rule can be given, but in each case the size, location and type should be selected after careful investigation. The man responsible for the working of the storm-water system must see to it that the paving around all inlets is properly constructed. This will, in many cases, be hard to accomplish, as it necessitates additional work for the paving engineer and contractor, and will probably shorten the life of the pavement at this point.

It is of vital importance that inlets be given proper consideration, since upon their design, construction and operation depends in large measure the efficiency of the whole storm-water sewerage system.

New Tests of Strength of Flame-Welded Joints in Steel Plate

OXYACETYLENE-flame-welded joints in steel plates ranging in thickness from No. 10 gage to 1 in. were tested recently at the Illinois Engineering Experiment Station by H. F. Moore. The joints were welded in a commercial welding plant and are believed by the experimenters to have been of considerably better average quality than flame welds made in a repair shop or similar establishments. The tests showed good tensile strength but low shock-resisting strength.

Repeated stress and impact were included in the tests, besides ordinary tension. There were 104 tension tests, 106 repeated-stress tests, and 58 tensile impact tests; the latter were made in a Hatt-Turner machine, in which the test piece and its two heads fall vertically to an anvil which arrests the upper head and thus ruptures the test piece in tension.

All the flame-welded joints were very much thickened by the welding. The experimenters denote the ratio of tensile strength of the welded piece to the tensile strength of unwelded plate as "efficiency of the joint," while the ratio of unit-stresses (which eliminate the influence of the thickening) is called "efficiency of the material." The latter is lower than the former.

The tests showed joint efficiencies ranging from 72% to 128% in static tension, the low figures being for ½-in. and 1-in. plates. About the same figures were obtained in the repeated-stress tests. In tensile impact, however, the joint efficiencies were very low, the range being 32 to 97%.

The efficiency of the material, in plain tension, averaged only about 75%. Hammering the joint tended to increase its strength, while annealing usually produced a slight weakening.

The full data are recorded in Bulletin 98 of the Engineering Experiment Station, Urbana, Illinois.

Galveston Seawall Extension Started

Preliminary work on the east end extension of the Galveston seawall has been initiated by the laying of a spur track to handle the materials. Construction methods will be somewhat different from the old method employed, in that the wall will be protected by concrete sheet piling instead of riprap.

Union Pacific Adopts Unit-Member Concrete Snowsheds

Permanent Structures Replace Emergency Wood-Frame Construction with Corrugated-Iron Covering Built Last Year in Wyoming

By W. R. Armstrong
Engineer Maintenance of Way, Union Pacific Railroad

During the winter of 1916-17 the Union Pacific Railroad Co. experienced considerable difficulty in maintaining traffic at several points on the Wyoming Division, on account of drifting snow. Both main-line tracks were completely blocked several times.

At Rock River, Wyoming, emergency wood-frame sheds with corrugated-iron covering were built during the winter to maintain traffic. Because of the great fire hazard and high cost of maintenance of this type of shed, the company decided to use a reinforced-concrete shed at points where the most trouble with snow had been experienced. A precast-unit type was decided on as being the most quickly constructed.

A STRETCH OF DOUBLE-TRACK PRECAST-UNIT SHED, OUTSIDE AND INSIDE VIEWS

The structure throughout consists of column-and-beam bents spaced 15 ft. apart, between which extend slabs forming walls and roof. Different forms of bent were required, according to the variation of track arrangement. The normal structure is double-track, with roof beams spanning the full width and resting on A-frame side supports. Three-track portions (where there is a center passing track between the main-line tracks) are spanned by plate-girder roof beams resting on either two A-frames or one A-frame and one solid-section post. These types are shown by the drawing herewith. In the transition from one to the other a central post is used where possible, and the roof has independent beams over the two bays. At a switch turnout near Rock River station a reinforced-concrete roof beam is used to one side of the center post, while on the other side, which has a longer span, a steel roof beam is used.

The steel beams, wherever used, are incased in concrete, as also shown by the drawing.

The A-frame type of side column was used on account of the exceedingly violent winds prevalent in Wyoming. Openings in the roof directly over the tracks, and in the walls near the eaves, were left, to assure prompt removal of smoke. Asbestos boards were fastened to the underside of the roof beams directly over the stack to prevent the engine blast from injuring the concrete.

The ends of the wall slabs fit in grooves in the A-frames; the roof slabs rest directly on, and have shoulders to bear against, the sides of the roof beams. The bottom of the A-frame fits in pockets in the pile cap with a ¾-in. clearance all around to permit exact adjustment of the A-frame. Four ¾-in. square rods project from the top of the A-frame and enter corresponding 2-in. pipes cast in the roof beams. The bottom of the A-frame is grouted into the pile caps, and the rods from the A-frame through the roof beam are grouted in with a thin cement grout.

Every seventh bay is braced longitudinally with 1¼-in. steel rod cross-bracing on the outside of the shed.

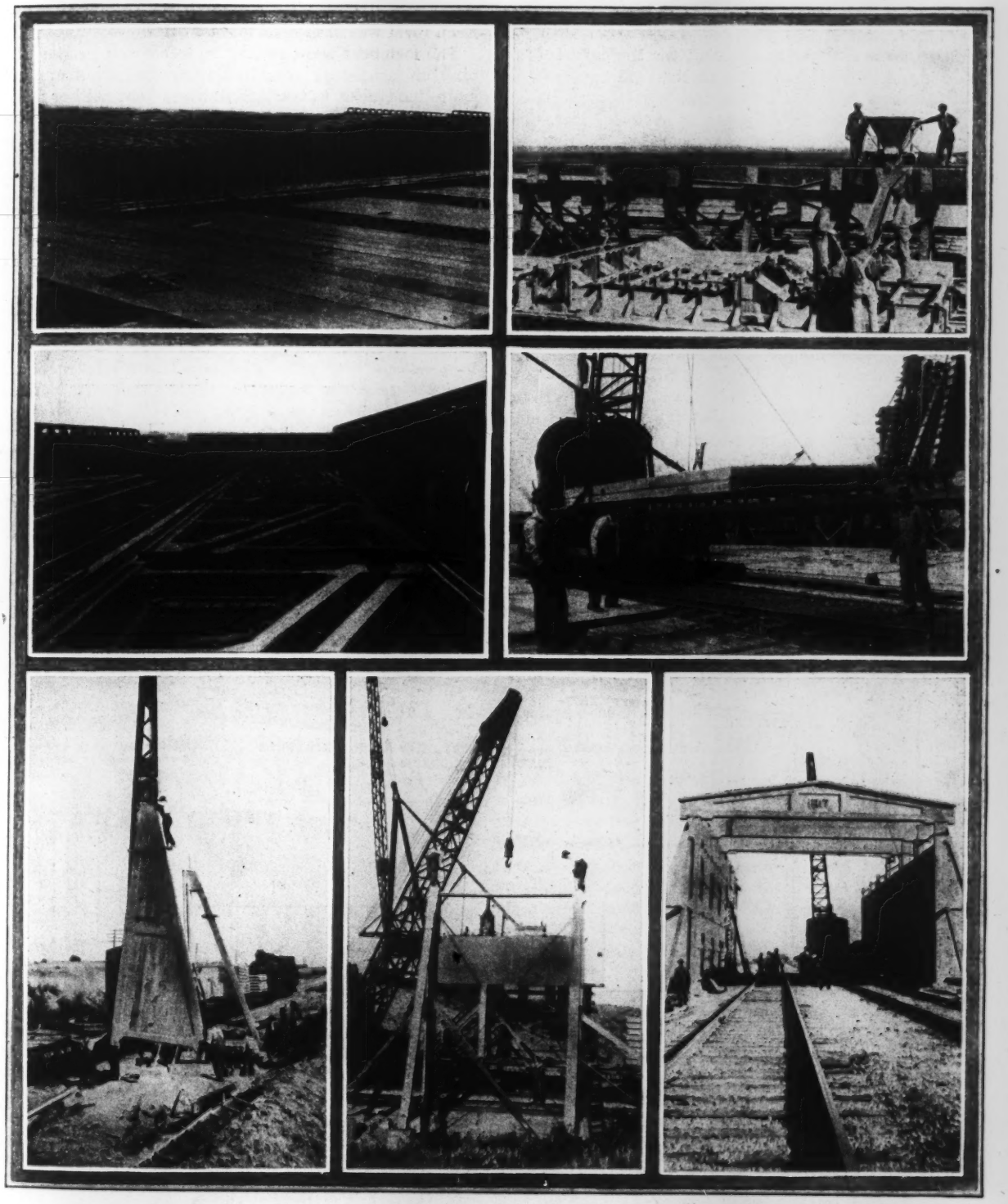
The sides and roof of the sheds were designed for 50 lb. per sq.ft. live load. The unit stresses in steel and concrete were those recommended by the American Society of Civil Engineers.

The Union Pacific standard 24-ft. vertical clearance was used, but on account of the permanency of this type of structure the side clearance was increased to 10 ft. to provide for any future increase in size of rolling stock.

Three types of footings were used, according to the varying character of soil: Precast piles, piles cast in place, and spread footings. The cast-in-place piles were used in firm ground. A mandrel pile was driven and drawn and concrete poured in the hole so formed.

Sheds have been built at Rock River, Wilcox, Medicine Bow and Sulphur Lake Cut, Wyoming.

At Rock River much of the work is of special design. The sheds are widened out at the station platform to 51 ft. clear, to give ample room for loading and unloading passengers. There is a clear opening in the shed walls of 28 ft. for a main highway crossing; other special details occur at the coaling station, switch turnout, etc. The length of concrete shed here is 4470 lin.ft. This concrete shed is supplemented by 1176 lin.ft. of



BUILDING CONCRETE SNOWSHEDS OF UNION PACIFIC IN WYOMING—A RADICALLY NEW TYPE, USING PRECAST FRAME AND SLAB UNITS

Four upper views show roof-beam reinforcement, handling concrete to forms in casting-yard, finished A-frames in yard, and slabs being loaded out of yard. Lower row shows erection of shed in progress

timber-frame shed covered with corrugated iron, which has all exposed timber incased in concrete plaster and is virtually fireproof.

At Wilcox 1500 ft. of double-track shed is built on 1° 6′ curve. The layout at Medicine Bow includes 1800 lin.ft. of double-track shed, over tangent track. At Sulphur Lake Cut 500 lin.ft. of double-track shed has been built on a 4° curve. Except for the curvature at Wilcox and Sulphur Lake Cut these sheds have no special features.

The mixing yard for all jobs was at Rock River. The plant consisted of one central tower 144 ft. high and two distributing towers 75 ft. high, with railroad serving tracks, elevated car runways, and form platforms between.

Sand and gravel were dumped from cars into pits and elevated by bucket conveyors to storage hoppers above the mixers. Cement was brought from the storage shed to the level of the charging hopper by a belt conveyor. Sand and gravel flowed by gravity from the storage hopper to the charging hoppers, cement was added, and the charge was dumped into two ¾-yd. Cube mixers below.

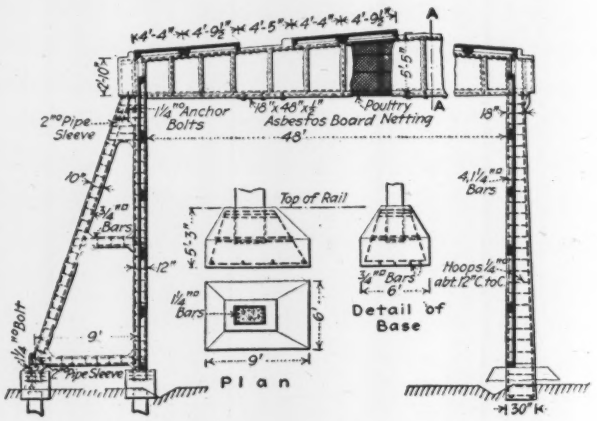
From the mixers the concrete flowed by gravity to two buckets—one for each mixer—at the foot of the main tower. After being hoisted to the receiving hopper it passed through pipes to hoppers in the distributing towers, and thence flowed through jointed troughs to small cars on the various elevated runways between the form platforms. It discharged from the cars to the forms by movable inclined troughs with openings in the bottom, which spanned the forms.

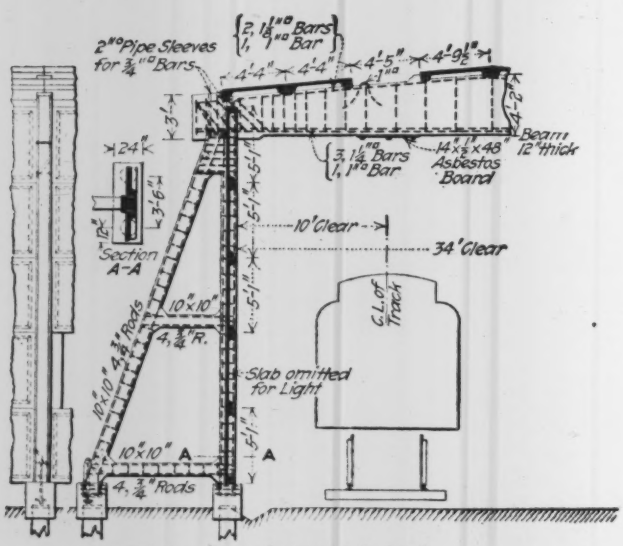
After the concrete was poured it was constantly sprinkled for three days. When five days old the members were removed from the forms, loaded on cars by cranes, transferred to the curing yard, and allowed to cure a minimum of two weeks before being erected.

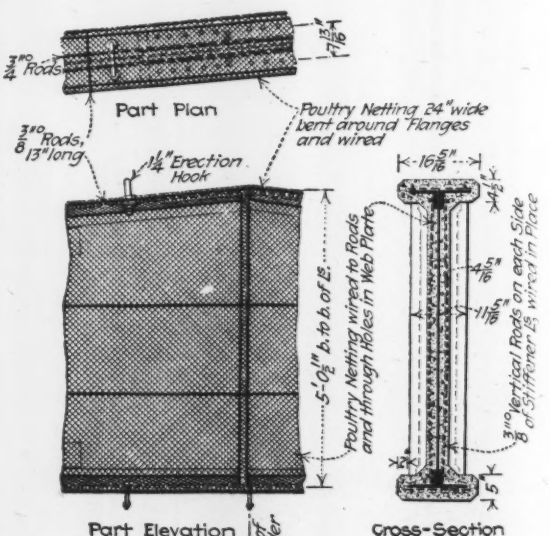
The forms were very strongly built, and their sides were hinged and held in place by wedges so that the members could be removed without damage to the forms. Each form was used from eight to 12 times.

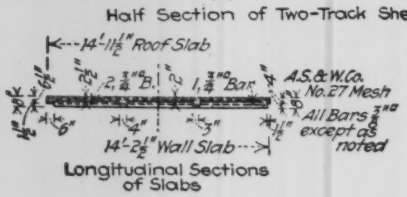
The members were erected by locomotive cranes running on temporary construction tracks paralleling the main-line tracks, as traffic is so heavy that neither main-line track could be spared for erection purposes.

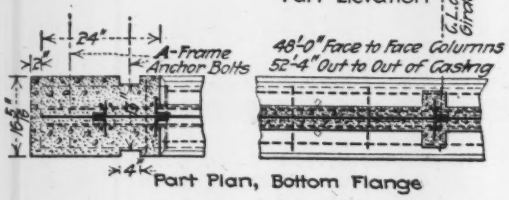
The work was carried out under the direction of the writer as Engineer Maintenance of Way. The plans were prepared by W. L. Brayton, bridge engineer. L. W. Althof was engineer in charge on construction. The Houghton Construction Co. of San Francisco was contractor for the work.






Part Plan
Part Elevation
Cross-Section
Poultry Netting 24" wide bent around Flanges and wired
Erection Hook
Rods, 13" long
Poultry Netting wired to Rods and through Holes in Web Plate
Vertical Rods on each Side of Stiffener as wired in Place





DETAILS OF TYPICAL DOUBLE-TRACK SHED AND OF THREE-TRACK SHED WITH PROTECTED STEEL ROOF GIRDER

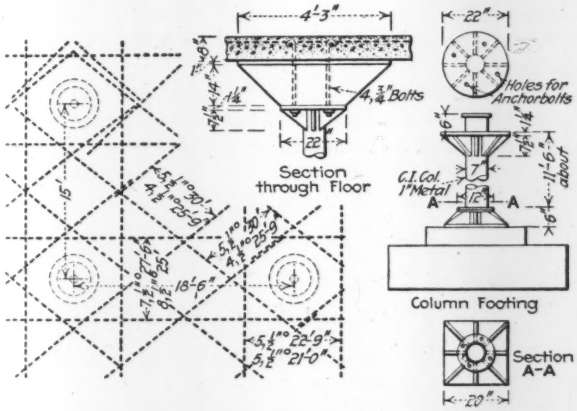
Cast-Iron Columns Carry Concrete Flat-Slab Floor

Clearances Requiring Small Columns Lead To Use of Cast Iron—Bending from Eccentric Loading Not Expected

By W. J. Knight
Contracting Engineer, St. Louis

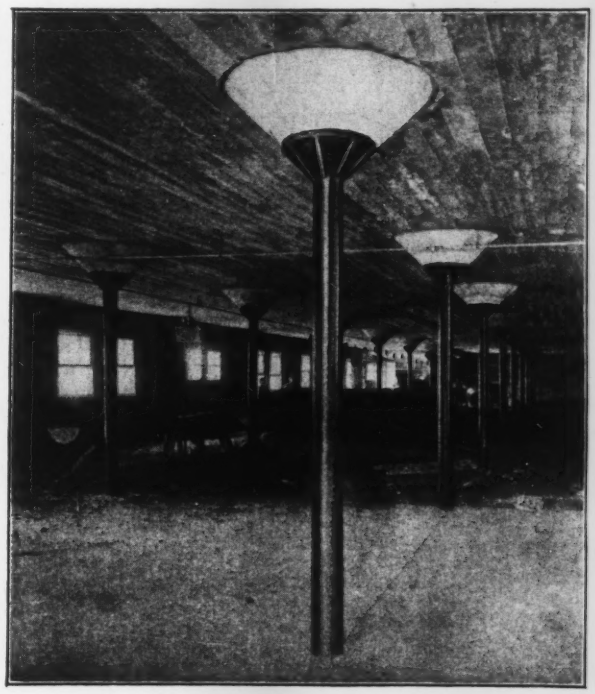
In A building designed by the writer and completed over six months ago a novelty was introduced in the way of cast-iron columns supporting the capital of a regulation flat-slab reinforced-concrete floor. So far as the writer knows, this is the first use of such a construction, and if it excites any criticism, favorable or otherwise, he would be glad to have expression of such criticism through the columns of this journal.

The floor in question is the roof of a one-story subsurface building 190 x 70 ft. in plan. On account of certain requirements established by the owner, the columns had to be reduced to the lowest possible section; hence the adoption of cast iron. The floor panels are of variable size, owing to the necessities of column spacing, but the typical mid-floor panel is, as shown in the drawing, 18½ x 15 ft. The floor-slab for this is 8 in. thick, reinforced by diagonal and straight bands as shown, but with no drop-head. The slab rests direct on a conical capital which fits into the cap of the 7-in. cast-iron column, the interior of which is filled with concrete when the floor is poured. As the detail shows, the column has a small cylinder projecting into the concrete of the capital, and the slab is further held by anchor bolts tied to the column cap. The base of the column is anchored to a prismatic concrete footing. Floor heights average 11 ft. The slab was designed for a live load of 100 lb. per sq.ft. plus an earth fill of 100 lb. per square foot.



FLAT-SLAB REINFORCED-CONCRETE FLOOR CARRIED ON CAST-IRON COLUMNS

In determining whether it would be feasible to employ cast-iron columns in this construction, the paramount consideration was the deflection of any one panel that might produce eccentric loading, and the consequent tension in the face of column opposite the loaded panel. All columns being on the interior, supporting loads from parts of four panels, it was concluded that the deflection of any panel loaded would not be sufficient to produce appreciable bending in the small 7-in. columns. It may be concluded, perhaps, regardless of any adverse opinion that may be advanced by engineers, that the structure has given entire satisfaction for a period of six months, having been subjected to static as well as heavy rolling loads.



ONE-STORY CONCRETE BUILDING HAS 7-IN. CAST-IRON INTERIOR COLUMNS

Chicago Opens Twelfth Street Widening

Improvement of Twelfth Street, Chicago, by widening it from 66 ft. to 108 ft., to form a new main traffic route, has been completed from Halsted St. to Canal St., and the opening of this section was celebrated by a parade and illuminations recently. The widening was done on the south side of the street. Most of the buildings were old and only a few stories in height; they included stores, the smaller class of industrial buildings and old residences. Some were wrecked, while others were moved back or cut back and fitted with new fronts for stores. The largest building moved was a church, estimated to weigh 8000 tons, with 1800 tons for its tower.

When completed this will be one of the new main streets of the Chicago Plan. The present work will be continued later on a width of 118 ft. to Michigan Ave., which is the present end of 12th St., and beyond this it will be extended to the lake front. A long viaduct 118 ft. wide will cross a group of railway tracks, and the Chicago River will be crossed by a 244-ft. vertical-lift span of the balanced-lever type. The work is under the direction of the Board of Local Improvements. Its estimated cost, from Ashland Ave. to Michigan Ave., two miles, was $4,500,000. This important improvement was described in *Engineering News* of Mar. 11, 1915, p. 482, and Mar. 23, 1916, p. 561, and in *Engineering Record* of Oct. 16, 1915, p. 494.

Caissons and Cribs for Lighthouse Foundations

Lights in Detroit River Channel Have Concrete Piers, Built in Timber Cribs or Formed by Concrete Caissons Sunk in Place

CONCRETE piers to carry the fixed navigation lights in the new Livingstone channel of the Detroit River required different methods of construction for different locations. The channel is about 8½ miles long and 300 ft. wide, and is to be widened to 450 ft. at some future time. It is on the west side of the river and is used for downbound traffic, leaving the older channel on the east or Canadian side for the upbound traffic.

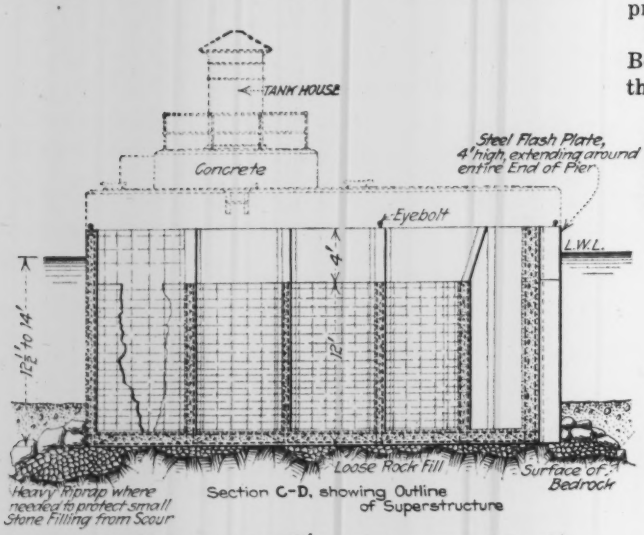
Piers for the four lights in the lower part of the channel are exposed and are subject to heavy ice pressure. They are situated 35 ft. outside the channel lines, so as to be on solid rock unaffected by blasting. Rock is 12½ to 14 ft. below water, and is overlaid by 2 to 8 ft. of stiff blue clay with boulders. The sites were dredged clean, and then covered with 4-in. stone for an area of about 30 to 50 ft. and for such depth as to cover all irregularities of the rock surface. This stone was deposited through a chute handled by a diver. A track rail suspended at the proper depth from a scow was passed over the site as a guide in leveling the stone.

Building these piers in cofferdams would have been very expensive. As the one-mile portion of the channel excavated within a cofferdam was then dry, it was decided to build reinforced-concrete caissons in this, and then float them into the prepared positions. As this section of the channel was to be flooded before removing the cofferdam, the caissons had to stand in water during one winter. It was desirable to have them entirely submerged at that time, to avoid damage by bursting stresses due to ice forming in the pockets. To provide for pumping out the caissons the upper part of each was made with a watertight form projecting 4 ft. above the surface. The only trouble experienced was the necessity of boring ice from the sluice valves in the bottoms of the caissons, as this closed the openings, so that the caissons began to rise as water was admitted to the channel.

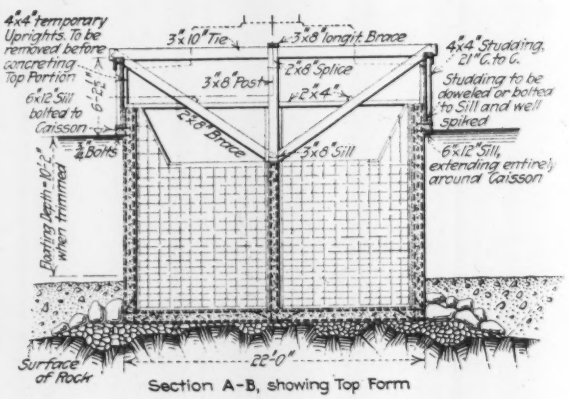
The caissons were designed for sufficient strength to care for shocks in handling and for unexpected but possible irregular stresses due to uneven surface of site. They were of such weight as to be stable when flooded, thus being safe if storms should interrupt the work before the concrete filling was placed.

Each compartment had a sluice valve, which could be operated by a wrench from the top, to control the sinking. The center four pockets could be pumped dry and concrete placed in the open while the other pockets were flooded, the weight of water in the remaining pockets being sufficient to hold the caisson firmly on its base. When these center pockets were filled with concrete, the weight would be sufficient to permit of unwatering the end pockets and filling them in turn with concrete placed in the dry. A steel flashplate for ice protection was provided.

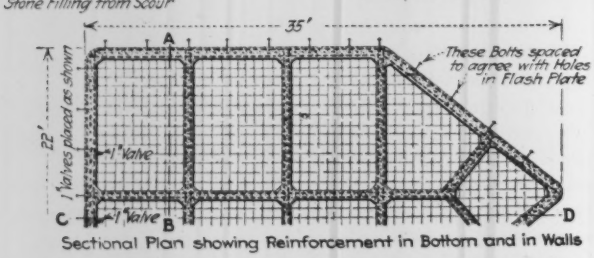
The bottom slab was molded in one continuous run. Bond rods for anchoring the side and cross walls to the bottom, and a corrugated galvanized-iron stop-water



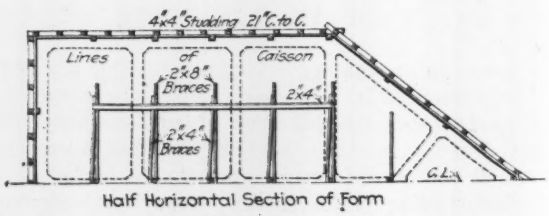
Section C-D, showing Outline of Superstructure



Section A-B, showing Top Form



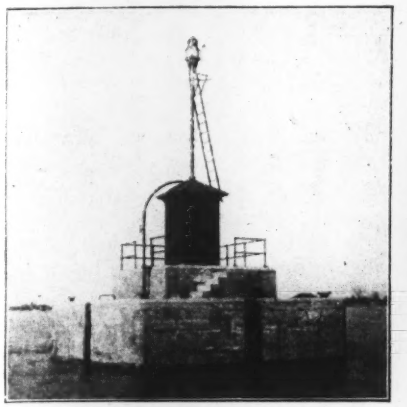
Sectional Plan showing Reinforcement in Bottom and in Walls

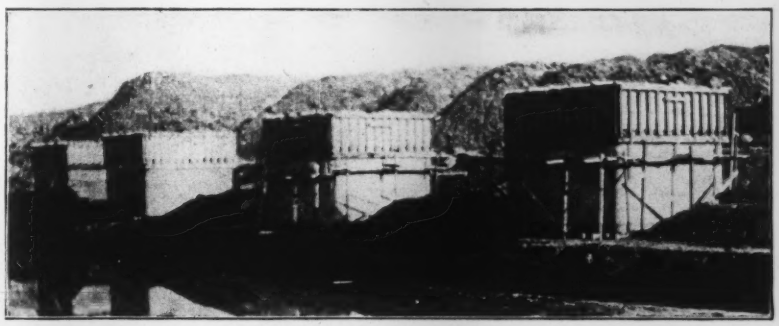


Half Horizontal Section of Form

THIS TYPE OF CONCRETE CAISSON BUILT IN THE DRY AND FLOATED INTO PLACE—NOTE WATERTIGHT FORM AT TOP

for waterproofing the joint, were built in as the concrete of the base was poured. This stop-water projected two inches into both bottom and side walls, and had the edges bent over at right angles. The forms for the side and cross walls were then erected, the flash-plate was placed and all of the concrete in the walls was placed in one continuous run to avoid joints in the work. The concrete was a 1:2:4 mixture, adopted after a trial of varying proportions to determine the densest mixture obtainable from the lake sand and gravel available. A natural mixed aggregate was used, varying the amount of sand or gravel by additions as necessary to maintain the required proportions.





ON LEFT, CONCRETE PIER CARRYING NAVIGATION LIGHT—ON RIGHT, CONCRETE CAISSONS BUILT IN THE DRY AND READY FOR FLOATING INTO PLACE

In the formwork for the bases of the caissons care was taken to obtain a support that would not yield with the weight or be undermined when the water was admitted. This work was of timbers 6 x 8-in., spaced about 20 in. centers, running across the pier and covered with 3 x 12-in. plank. All timbers were well blocked up by stone. Two complete forms were used. The form for the body of the pier above water was carried by a 6 x 12-in. timber secured by bolts set in the concrete when poured. This form was built of 4 x 4-in. studs double sheathed with ⅞-in. matched flooring, breaking joints and calked against the concrete pier with oakum to make a watertight joint. It was also well braced to stand shocks of moving and to support machinery used in placing the concrete filling.

With a view to securing additional watertightness, a patented waterproofing paste was mixed with the concrete as placed. The engineer states that the use of this material is believed to have been of little value and in the case of one pier came near causing trouble, owing to its tendency to create foam and accumulate on top of the concrete as it was being poured. Heavy rain made it necessary to stop pouring on the side walls of this pier, so there was a joint in the work. The side walls were purposely poured higher, allowing what laitance there was to accumulate in the center walls. This foam-like material hardened just sufficiently to support the new concrete when placed, with the result that there were places at this level in the inside walls where a bar could be readily run through the wall when the forms were removed. Fortunately, no bad spots occurred in the outside walls, and those in the inside walls were easily repaired.

The first caisson was pumped out after some difficulty, owing partly to the insufficiency of the plant used and partly to the lack of large valves connecting all chambers of the caissons so that the pumping in one pocket would lower all uniformly. The caisson itself leaked very little, the chief leakage being around the joint between the caisson and top form, which had been loosened by the vibration of a 4-in. centrifugal pump situated on the cross-framing.

The contractor attempted to place this caisson by means of lines to kedge anchors previously placed, but this method was found to be inaccurate and to require much time, it was risky and generally unsatisfactory. Wind and current made it almost impossible to secure an accurate location by this means. The remainder of the piers were placed by bringing them alongside a derrick scow equipped with spud anchors and placed by transit in the approximate position. In this way it was possible to secure an exact location without difficulty, as the derrick scow could readily be swung to the desired position by lowering the heavy clamshell bucket, using it as an anchor and swinging on one or the other of the spuds.

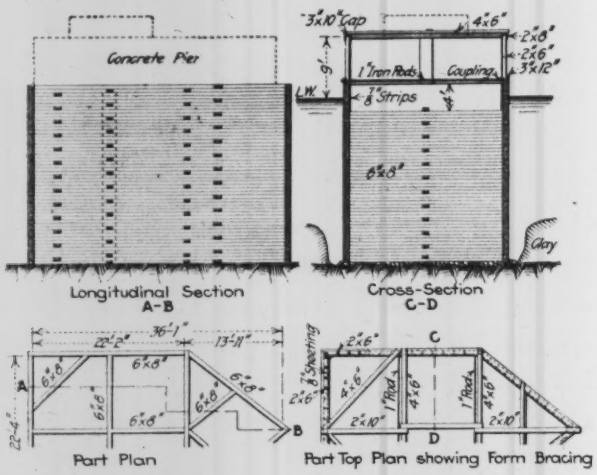
All piers were examined by a diver after the caissons were placed to see if the bearing on the rock fill was uniform. Some small holes were found. These were filled, and subsequently a layer of riprap stone was placed around each pier to prevent possible scouring of the stone fill. The placing of concrete in the piers was completed according to the program outlined, without difficulty. No movement of any kind has taken place. Before concreting above water, the forms were adjusted to take up any irregularities in the level of the caisson as placed, giving a plumb surface on all sides above water. All concrete was mixed by a ½-yd. Cube mixer. The plant and materials were carried on a large scow brought alongside the pier.

Piers were built for two intermediate lights, as gas-buoys used at these locations were frequently shifted by the cross currents or by vessels striking them. The method adopted was to build timber cribs, tightly made and well braced, covered on the outside with canvas. These were towed to position and sunk by the placing of heavy weights on top. The sites were prepared in advance, as for the caisson piers, and a diver was used in placing to secure a firm and even bearing and to stop all openings through which concrete might escape.

Both piers were filled with concrete placed in the wet by the tremie process. The mixture used was the same as for the concrete caisson work, and no difficulty was

experienced. The timber cribs were made about 3 ft. higher than the water level. The forms for the upper work started inside them below water level and continued up to the same height above water as for the other piers.

This method of construction was adopted in preference to reinforced-concrete caissons, partly owing to the necessity of constructing launching ways and partly because of the loss of time in seasoning. It also proved to be very economical and the procedure is considered to be entirely satisfactory providing proper care is taken in the use of the tremie for placing the concrete. The timber cribs were built to a height of about 4 ft.



TIMBER CRIBS USED FOR PIERS FOR INTERMEDIATE LIGHTS

on the dock, launched by a derrick and then built up on the water, the canvas being placed as the work proceeded. After completion of the piers, all form work was removed to 12 in. below water.

Four Piers Built by Floating Plant

Piers for the six lights in the cofferdam section of the channel were built in the dry. Here the solid rock was covered with 1 to 5 ft. of clay and shelving limestone rock. The four piers at the ends of this section were built by means of a floating plant on the outside. For the two middle piers, material was transported by the industrial railway and cableway used in the channel excavation. The sides of the channel were channeled to the full depth before blasting, so that the rock in the pier foundations was unshaken. The piers were placed with their centers 21 ft. from the channeled edge, leaving a 10-ft. berm.

The piers are 22 x 35 ft., including a cutwater on the upstream end. The main body of all piers is carried up to a height of 9 ft. above low water. The body of the piers was made of concrete mixed in the proportion of 1 part portland cement to 3 parts lake sand and 5 parts hard broken limestone ¼- to 1½-in. size. One-man stone plums from the channel excavation were permitted to be imbedded in this, in amount not exceeding about 15% of the whole. It was required that these stones should be washed and thoroughly bedded in the fresh concrete, the spaces between adjacent stones and between stone and forms to be not less than 12 in.

The upper 6 in. of each pier were mixed richer, about 1:2:4, and of fine material, troweled to a smooth finish without plaster coat or surface wash of any kind. The cut-water portion is protected against running ice by a belt of ⅜-in. steel plate 4 ft. wide, centered on the water line, and held in place by countersunk bolts imbedded in the concrete as placed.

The contractor's floating plant consisted of a material scow on which stone and sand were stored, and a working scow equipped with a steam hoist, derrick and ½-yd. concrete mixer. The latter was mounted on cribbing and served by the derrick. Cement was stored in a shed on the working scow. From the concrete mixer the concrete was discharged into a side-dump car and carried on trestlework to a point over the pier, where it was emptied into a movable chute. The concrete for the two center piers was mixed by hand.

The pier forms consisted of 3 x 6-in. studding set about 18 in. on centers and sheathed with ⅞ x 3¼-in. matched Norway pine flooring. Fillets of the flooring material set vertically and secured to radius blocks were used to form the rounded corners. Two complete forms were made to serve for all piers, the sections being so arranged that they could be used over again. These sections were held by 6 x 8-in. wales lapped and bolted at the corners and tied by ½-in. rods extending across the pier. The wales were spaced about 4 ft. 6 in. apart in a vertical direction.

All necessary ironwork, such as landing ladders and boat cleats, and all anchor bolts for the superstructure, were placed as the work progressed. The superstructure of each of the 12 concrete piers consists of a square steel tank house placed on a raised portion of the pier. Pipe railing, landing ladders and boat cleats are provided, and there is a davit with block and tackle for handling gas tanks.

Cost of the Work

The appropriation for lighting the channel was $210,000. The work has cost about $145,000, distributed as follows:

6 concrete piers	$37,950
4 concrete caissons	12,000
Preparing four sites, placing caissons and concreting	24,900
Metal work, 10 piers	5,860
2 cribs, placing and concreting	15,200
10 pier lights and acetylene-gas equipment	15,700
16 oil-gas buoys with light equipment	26,000
Spare equipment, tanks, lanterns, etc., for acetylene and oil gas lights	6,790
Semaphore control system	600

The four concrete caissons were built by the Benjamin Douglass Co., of Detroit. The six concrete piers were built by John Ginzel, of Wyandotte, Mich., who also placed and filled the concrete caissons. The building of the two intermediate piers was done by hired labor under the direction of the lighthouse inspector at Detroit.

Plans were prepared by Charles A. Park, superintendent of the 11th Lighthouse District, at Detroit, under the direction first of Commander C. M. McCormick, U. S. N., and then of Edward L. Woodruff, who succeeded the former as lighthouse inspector. The work was under J. S. Conway and H. B. Bowerman, who successively held the office of chief construction engineer of the Bureau of Lighthouses, Washington. Plans and information as to the work have been furnished by Mr. Woodruff, by authority of the Secretary of Commerce.

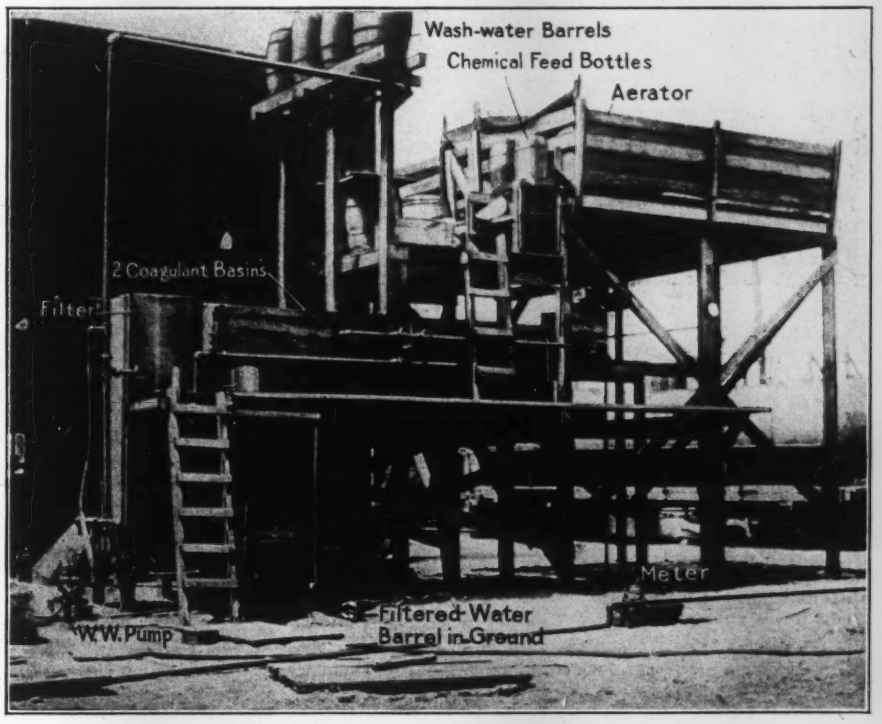
Coagulant and Filters Remove Oily Tastes and Odors

Experiments at Whiting, Ind., Show That Aeration May Abstract Oil from Air—Leaks Cause High Consumption

CONTACT with a flocculent coagulant was found at the experimental filter plant at Whiting, Ind., to eliminate oily tastes and odors from Lake Michigan water, if followed by filtration. Aëration is desirable at times, and under certain lake conditions the aëration assists in the removal of the oil odor and permits operation with a smaller amount of chemical. At other times the air contains oil in a gaseous state which the spray collects.

These are the conclusions of Langdon Pearse and S. A. Greeley, consulting engineers for this oil refinery city of 8260 people. In a preliminary report submitted in March aëration coagulation and filters were recommended, but to study the coagulant and aëration factors a simple testing station costing about $300 was installed. The second report has recently been made and the city has decided to go ahead with the design of a 4,500,000-gal. rapid filter plant.

Whiting's needs arise from badly polluted water and an extremely high consumption, 425 gal. per capita per day. The pollution is by sewage discharged from various municipalities and by the industrial wastes from large manufacturing establishments.



OIL REMOVAL STATION AT WHITING COST $300

The industrial sewage has an important bearing upon the treatment of water-supplies from the lake. In addition to the wastes from the Standard Oil Co., which at times give the water a distinctly oily taste, there is also the waste from the steel mills, which are being increased in size at a rapid rate. The waste from these plants includes the quench-water from the coke ovens, which gives to the water a taste similar to that from an overdose of chlorine. The waste from the corn-glucose factory at Robertsdale is also important. Frequently the water is decidedly turbid and occasionally is infested with substantial growths of micro-organisms which impart their characteristic tastes and odors. It was concluded, therefore, that turbidity can be removed only by filtration, and this process, coupled with proper auxiliary treatment, can also be used to remove the tastes and odors due to the industrial sewages and the microscopic organisms.

The present water-supply of Whiting is taken through a 66-in. brick tunnel extending approximately 2400 ft. from the pumping station to water approximately 20 ft. deep. The end of the intake is approximately 1600 ft. from shore and 1900 ft. from the discharge of the main sewer of the Standard Oil plant. The Front Street sewer is about 3700 ft., and the Atchison Avenue sewer about 8300 ft. distant from the intake.

The intake used is of ample size to serve the needs of the city and the Standard Oil Co., and is giving good service. Troubles from anchor ice are comparatively infrequent. The pumping records indicate only one shutdown in the city supply in the past ten years, that being on Feb. 3, 1916, for a period of three hours. The water is pumped by the Standard Oil Co. at a nominal charge to the city.

After passing through the 66-in. brick intake the raw water enters a suction well designed to retain floating oil. This suction well comprises a circular portion 9 ft. in diameter and 71 ft. deep to the tunnel. A rectangular portion 6 x 40 ft. and 26 ft. deep extends to the north. Seven suction pipes lead out of this, each taking water from several feet below the surface. It is apparent, however, according to the report, that the well can have no very great effect on the removal of the oil taste from the water.

A liquid chlorine apparatus of the Electro-Chemical Bleaching Gas Co. make, installed and put into operation on Feb. 17, applies chlorine at the rate of about 6.5 lb. per day. No regular routine analyses are made, and the amount of chlorine applied is not adjusted to meet the variations in the quality of the raw water. The effect of this treatment on the typhoid fever rate has been very slight.

Pitometer tests were made to check up the pump displacements, and from past records the average pumpage

per capita for the years 1912 to 1916 inclusive were calculated as follows: 295, 302, 304, 321 and 425 gal. Adjacent cities have daily consumption per capita as follows: Hammond, 300; East Chicago, 225; Chicago, 250; Evanston, 219; Oak Park, 77; Gary, 96. Oak Park and Gary are fully metered. Investigations indicate that meters in Whiting would probably reduce the consumption to 100 gal. per capita per day. Leaks in the distribution system probably account for the difference between Whiting and the cities of Evanston and East Chicago, where there are few meters, but the distribution systems are in comparatively good condition. It was concluded that it was desirable to make a determined effort to reduce the consumption to 200 gal. by overhauling the distribution system, thus reducing the size of filter plant required.

Testing Station Simple

Raw water to be tested was taken from the main factory supply line and was not treated with chlorine. It passed first to a standard aërating nozzle made by the Spray Engineering Co. The purpose of the aëration was to break the water into fine drops, thus exposing a large surface to the air and facilitating the escape of any gases or oils.

A hopper-shaped galvanized-iron basin collected the aërated water, whence it flowed by gravity to a stilling box fitted with an overflow weir, the height of which regulated the amount of water flowing to the two coagulating tanks and a rapid filter. The nozzle was screwed on the top of a 1¼-in. pipe entering the bottom of the hopper through the center of the 6-in. collecting pipe.

Comparatively minute quantities of coagulant were required. Five-gallon bottles were inverted over ordinary pails to give a constant head. Through the bottom of the pails extended a ⅜-in. glass rod or copper pipe with a small hole in the side near the bottom of the pail. Adjustment of rate was made by moving the rod up or down through the rubber stopper in the bottom of the pail and measuring the flow.

The filter was of the Harrisburg type, with a set of perforated pipe underdrains. Experience in washing indicated the need of an auxiliary wash grid, a few inches above the sand surface, to stir up the sand between washes to increase the run and also to wash the grains more thoroughly than the ordinary wash from the underdrains. This follows the experimental experience in Oakland, Calif., and operation experience of several years at Urbana, Illinois.

Aëration Washed Oil from Air

Analyses of the composite samples of the aërated water indicated a reduction in the intensity of the oil odor due to aëration. Observations at the plant showed that at times certain oil substances were washed out of the air by the fine spray. These appeared as an oily scum on the surface of the water in the stilling box and coagulating tanks. Later on the plant was operated without aëration and the coagulating tanks were arranged to run in series. In this way the period of contact between the alumn precipitate and the water was increased, due to the more rapid velocity. It was found that with this arrangement the oil odor was removed as well as with the aëration.

Conclusions as to aëration were, therefore, that it was desirable to arrange for its use at times of favorable atmospheric conditions.

At times during the investigation it was found difficult for the chemists while in Whiting to fix the intensity of oil odor in the raw water because of the odors in the air. Virtually all the tests at Whiting were positive, but in Chicago some negative results in the raw water were obtained. Tests on the filtered water, however, were virtually always negative.

Kansas Encourages Land Drainage and Irrigation

State Exercises Advisory Functions—Stream Flow Is Being Measured—Irrigation by Pumping Is Profitable

DRAINAGE and irrigation in Kansas are considered to present a favorable outlook for 1918, but both kinds of work are undertaken mainly as local and independent projects, so that it is difficult to predict conditions very closely. Supervision of such projects is exercised by the State Department of Drainage and Irrigation Engineering, which was established in 1912.

This department is organized in connection with the Kansas State Agricultural College at Manhattan, and is included in the College Extension Division for work done in coöperation with the Federal government under the Smith-Lever fund. Its main purposes are to promote a better understanding of the value of irrigation and drainage, to assist farmers in planning drainage systems and individual irrigation projects, to give assistance in the formation of drainage districts, to provide plans and specifications for drainage and irrigation works, and to give general supervision during the construction of such reclamation projects. J. B. Marcellus is engineer in charge of the Department.

In relation to drainage work, the Department acts in an advisory capacity only, unless it is directly authorized to assume authority by the board of supervisors of any particular district. In such cases, its duties then consist in making surveys, plans, specifications and estimates of work, together with the prorating of assessments.

Examinations of 55 farms for drainage improvements were made by the Department during the year that ended June 30, 1917. These improvements included nearly 100 miles of tiling. Assistance was given also on 27 drainage projects, involving the prevention of overflow of crop lands. These districts averaged 5000 acres each, with a maximum of 15,000 acres.

Proposals for construction work in a drainage district involving 87,850 cu.yd. of excavation have been invited recently by the Department, and it is preparing plans for another district in which straightening of a river channel will require about 500,000 yd. of excavation. A third district, in the Marais des Cygnes, is having plans prepared by a consulting engineer.

Under the drainage law of 1911, a majority in interest of the owners in any body of swamp or overflowed lands, situated in one or more counties, may organize a drainage district for reclaiming and protecting such lands. The area of the lands in the district must be

not less than 160 acres. A board of five supervisors is then elected from among the landholders, the members to hold office for from one to five years. A supervisor is then elected annually to take the place of the one who retires.

Under the law a topographical survey of the district must be made by a competent engineer. The engineer's report must give complete plans for draining, reclaiming and protecting the lands, and the plans must show all railways, bridges and highways. He is also required to assess the benefits on any corporate land. A drain commissioner must be appointed by the board of supervisors to award contracts and to superintend construction and maintenance work. Bonds may be issued to the amount of the total tax levy.

Authority is given the board to clean out and remove obstructions from any stream or to straighten its channel, but not to divert the water unless compensation is paid. Before letting any contract, the work must be advertised for 20 days in a newspaper of the county or counties concerned. After the completion of the work the board may appoint not more than three overseers to keep the ditches, levees and other works in good repair.

Irrigation is confined to the western part of the state, and is undertaken mainly by the organization of individual projects under separate management. The report of the Department of Drainage and Irrigation Engineering for the year that ended June 30, 1917, states that 47 such projects had been examined, many of them being pumping plants used to insure against crop losses in dry seasons. The report states that at present prices irrigation by pumping could be made very profitable.

Special flood and storm problems in different localities have been given consideration by the Department. The largest project for flood protection is that of the district along the Kaw River, between Kansas City and Topeka. No active work is being done on this, as the main part of the project has been completed.

A Water Commission was created by the legislature in 1917, for the purpose of working in conjunction with the U. S. Geological Survey in collecting data for flood-control investigations. Stream measurements on some of the more important streams are now in progress. Mr. Marcellus is also engineer for the Water Commission, succeeding H. B. Walker, who is now in the army.

Concrete Stream Fords in Philippines

Guided in part by experience in the United States, fords in the Philippines are being improved by constructing low-level concrete bridges. According to the latest annual report of C. E. Gordon, chief designing engineer, Philippine Bureau of Public Works, the chief essentials of these improved fords are: "(1) A structure of sufficient waterway to pass dry weather flow, (2) deck at a somewhat lower level than the drift-carrying stage of the stream, (3) approaches reaching back to the high-water contour, having the stability requisite to pass extreme floods. A concrete metaled-section is used which successfully stands submersion and resists current erosion for an appreciable period of time. This type of structure appears to be particularly suited to flashy streams, of considerable width between main banks, and to roads where traffic in stormy weather is difficult and sparse."

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Intelligent Statutory Regulation of Engineering Practice

Sir—In conversation with two other engineers yesterday the talk drifted into statutory regulation of the practice of engineering. Mr. A made the point that people who employ an engineer to survey land should have some assurance of the competency of the surveyor, and deduced that at least land surveyors should be licensed. He cited instances where lines are in dispute or uncertain, and the likelihood that the interested citizens would call in a surveyor to determine the lines without ascertaining his competency. He inferred that it shouldn't be expected of the layman to pass upon the competency of the surveyor. He thought the surveyor ought to be versed not only in the mathematics of surveying, but also in the law of it. Anybody who can find a stone and turn an angle with a transit can set himself up as a land surveyor in our state and do things of much concern to many people. Mr. A's opinion is worth more than the average, because he comes in contact, through the city survey department, with the evils of incompetent surveying.

Mr. B related an experience in——, where he was called in consultation on the superstructure of a proposed roller-lift bridge after the situation had developed into a cat-and-dog fight between the promoters of two types of lift bridge. The county surveyor, who was present at the conference with the commissioners, had "designed" the masonry, and the bridge companies had incorporated his design in their superstructure. Mr. B saw the deficiency in carrying capacity of the masonry and called attention to it. This the county surveyor resented. The masonry was built to the surveyor's plans, settled, and the bridge failed to work until the masonry was underpinned, approximately at the cost of reconstruction. To save his face with his constituents—the public whose money he had wasted—the surveyor explained that all precautions known to the art had been employed and, to prove the point, further informed them that Mr. B, bridge engineer of the —— railroad, had been called into consultation.

Perhaps we can excuse this surveyor's human weakness, falsifying to obey the first law, self-preservation. But the point is that the county surveyor comes in contact with many people who have no other standard to form their impression of the whole profession. Mr. B cited the example to show that the county surveyor should measure up to a certain standard. This surveyor was not competent to design anything but the simplest foundations, but how should the public know that? A board of examining engineers would know it and not permit such a man to practice in that field.

The trouble with our attempts to secure statutory regulation is that they have been on a low plane, agitated by just such men as this surveyor, to get salary raises. Never but once has such an attempt been on the

high plane of protecting the public. The queer thing about it is that the highly trained members of the profession have bent their efforts to heading off regulation rather than to putting it on a high plane and to directing its course. The obvious thing to do is to require a minimum educational standard, a knowledge and an understanding of the principles of engineering. Then we would not have the spectacle in one state of a common school teacher, in another a telegraph operator, and in still another a man who couldn't solve trigonometrically a plane triangle, being chosen for public engineering positions.

INTELLIGENT REGULATION.

Mill Construction Growing in South

Sir—The editorial comment in your issue of Dec. 27, 1917, on F. W. Dean's article on standard mill construction, states that unfortunately such construction has remained a localism in New England.

We wish to take decided exception to this statement for the reason that this company has built probably one hundred buildings of standard mill construction in North and South Carolina, Georgia, Alabama and Tennessee.

It is true that the majority of these buildings were designed by New England architects and engineers, but to the writer's personal knowledge there have been a great number of these buildings designed in the last few years by Southern architects and engineers, and the buildings are such that they can be considered of the standard mill type in every way.

They differ in some of their details from that shown in Mr. Dean's drawings, but these are only minor variations, and the same results are obtained as pointed out by him.

FLYNT BUILDING AND CONSTRUCTION CO.,
Boston. Charles F. Dingman, Engr.

Testimony of Engineers in Technical Litigation

Sir—The desirability of presenting the expert testimony of engineers in present day technical litigation is becoming evident more and more to the legal profession, and as a result many engineers are called in for this purpose who do not realize the seriousness of the work and the possibilities of injury to their own reputation and to the engineering profession as a whole. As a usual thing, the work is fairly remunerative and opens up an additional source of income to many engineers, but no one should accept such a commission blindly and without a definite conception of his ethical relations to the court, to the plaintiff, to the defendant and to his own profession.

In most cases, when one or more engineers are retained on one side, others will be found on the opposite side as well. This leads to an appearance of disagreement among engineers which may be exceedingly harmful to both sides of the case in litigation, and to the professional standing of the expert witnesses. The majority of judges and jurors have no engineering training and must necessarily rely on such technical evidence as is easy of comprehension by one having no such knowledge. It therefore behooves the engineer to give an absolutely straightforward statement of the facts as he sees them from a technical standpoint, without the least show of prejudice or favoritism, and so to translate the technical findings that they may be understood in a comprehensive manner by the layman. Evasion, unnecessary verbiage and technicalities for the purpose of confusing the attorneys and jurors are decidedly bad for the case and for the engineer on the stand.

A particular show of favoritism leads the court to believe that the witness is being paid to testify in a certain way for the benefit of the side by which he is retained, and if the expert testimony as given by the other side should differ in a material way the witness is in a very precarious position and may even be in danger of an impeachment.

As a general rule, the statement of material facts by all the engineers, regardless of the side on which they find themselves, should agree, and if the witnesses are conscientious and competent the technical facts will agree very closely. However, when it comes to matters of opinion this is rarely the case, and it is here that the technical witness should be very careful indeed that his judgment is not warped by his relation to the case.

The engineer should remember that it is not his place to help win the suit for either side, but it is his place to furnish the technical facts upon which the attorneys can later base their arguments. In fact, it would appear to be advisable for the courts to summon the expert witnesses instead of the litigants, so there could be no leaning from the straight and honest statement of facts regardless of whom they help or hurt.

If we leave out of consideration the giving of biased and false testimony and deal with facts only, there are yet ways in which experts may appear to give conflicting testimony. One side may present only those facts which bear upon the case in a favorable manner to themselves, leaving unstated any other matters which might be favorable to the opponent. Thus the engineers on one side magnify certain facts, leaving others unmentioned, and the opponent does likewise, but with opposite ends in view, and with different facts under consideration. In an instance of this kind the conscientious engineer meets with the ethical question as to whether it is right to state certain facts and leave unstated other correlated matters which might be necessary to the attainment of the truth.

This is a practice which appears to be very bad for all engineers concerned and yet it is increasingly common. The engineers on one side state such facts as will improve their case and those on the other side do likewise for their own side. Here all the statements may be within the facts and all the testimony absolutely true as far as it goes, but the general effect is to leave a bad taste in the mouths of the jurors and the judge.

To obviate such procedure, an engineer should not accept employment as expert witness from anyone unless he does so with the understanding that he will be allowed to state the facts, and all of them, bearing on the general results, without any other end in view except that of reaching as nearly as possible the absolute truth of the matter in contention. If this will be prejudicial to the employer he has the privilege of withdrawing his request for engineering service.

This stand will probably result in fewer requests for the engineer to serve as a witness, but it will also result in raising the public opinion of engineering as a profession. We must remember that ordinarily the engineer is little in the public eye, and his actions in court are on that account more conspicuous. No place is more potent for advertising character and professional attainments than the courtroom and it is in this very fact that the danger lies.

The next time any of us are called upon to testify regarding technical matters let us carefully consider the question in all its phases and not rush in blindly, possibly to our everlasting regret. D. R. SHEARER.

Johnson City, Tenn.

Prefers Vertical End-Posts in Bridges

Sir—The writer has noticed that most American bridges have trusses in which the top chord is omitted in the end panel, so that there are no vertical web members above the bearings. The sketch, Fig. 1, shows this arrangement. The writer is accustomed to trusses whose end panels are complete (Fig. 2) and he sees some advantages in them. While these advantages no doubt are known to American engineers, he begs to recall them:

1. The diagonal member in each end panel may be made a tension member instead of a compression member, and it will nearly always be reduced in length.

2. The end floorbeam may be shaped as indicated in Fig. 3, by which it stiffens the end posts and thus gives

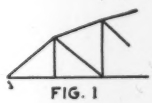


FIG. 1

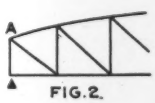


FIG. 2.

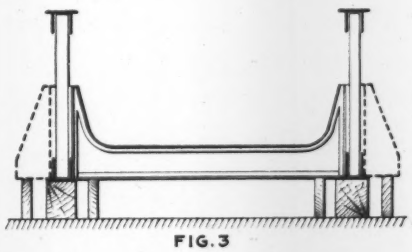


FIG. 3

lateral support to the point *A* (Fig. 2) of the trusses. Thus point *A* can resist the action of the top-chord horizontal bracing (even when a transverse bar at *A* is impracticable because too low to give clearance) provided only the top-chord bracing can be extended to point *A* without fouling the clearance. Even if the top-chord bracing cannot be extended into the end panels, yet making firm the ends of the top chords still seems to be a good thing. The arrangement shown in Fig. 3 also provides a girder which will be strong enough to carry half the dead weight of the span when jacks are placed under it in order to lower from erection level to bearing level, or in order to carry out repairs at a later time.

It will, perhaps, be objected that the arrangement shown in Fig. 2 is less economical than that of Fig. 1. But that argument is debatable. First, the diagonal tension member in Fig. 2 will certainly be of less weight than the compression member in Fig. 1, even if axial strains only are taken into account. If secondary stresses caused by bending in the truss plane are also considered, it will be seen that Fig. 1 provides only two members to resist a certain bending moment, while Fig. 2 provides four. The two members must therefore be exceptionally strong.

If secondary stresses were only a nuisance, it might be unjustifiable to add members otherwise unnecessary, merely for the sake of taking secondary stress. But it must be considered that the bending of web members relieves the chords of a certain amount of strain. In other words, web members act in some degree as the web of a plate girder. The section modulus of a truss whose chords have each the cross-sectional area *A* and whose depth is *h* is not simply *Ah*, but something more, which depends on the importance of the web members.

The writer is anxious to know what decisive argument can be advanced in favor of the arrangement, Fig. 1.

E. BOUCHER,
Engineer, Egyptian State Railways.

Cairo, Egypt.

Variations in Transit Needles

Sir—I have noted with interest the article by W. Newbrough in *Engineering News-Record* of Dec. 13, p. 1119, on variations in transit needles.

Theoretically, the variations possibly should be the same, but practically they are not, for it is here that many elements enter, particularly the personal equation, in the manufacture and magnetizing of the needles. We may use the identical material, magnetize apparently in the same manner, and still have one needle very lively and another sluggish. I have noted this many times in using two different needles on the same transit, both balanced perfectly, with a good sharp pivot point, perfect centering in both needles; one needle would appear sluggish, the other very lively, giving a difference in variation from thirty minutes to one degree.

I have always held, from ten years' practical experience, that a variation found in a locality is the variation of the particular instrument used, and not a general variation for all transits used in the locality; though I have seen on more than one occasion surveyors take from a map of a survey (made by some other engineer less than a year before) the variation as shown thereon, go into the field, set off this variation and try to retrace the line as located thereon. After running a short way they would swear that the variation shown on the map was wrong, when the variation shown on this map was simply the variation of the particular transit used at that time.

I use three transits, a Solar, a Sietz and a Young, and each one gives a different variation; though I consider this as it should be for the reasons stated above. But if an engineer goes into the field and establishes a meridian by an observation on Polaris at elongation, he notes from the instrument its variation, and he should use this variation for this particular transit only. The same should be done for each individual transit; then when you wish to retrace a line of a certain bearing you must use the particular variation for the transit used, and not a variation as found by an engineer for some other transit, as the old saying goes that "North is North," let the variation come what it may.

G. A. STRAND,
Eureka, Calif. City Engineer.

HINTS FOR THE CONTRACTOR

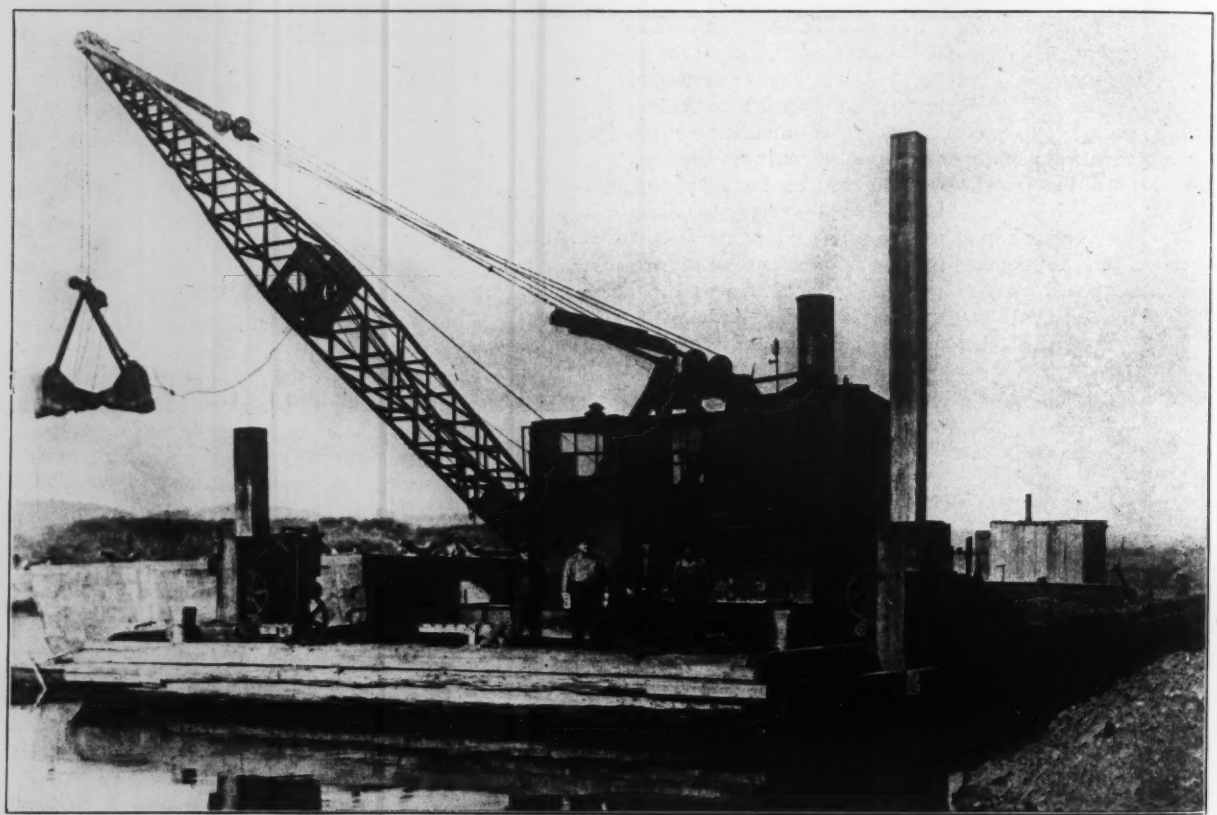
DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Useful Sweep Boat and Drag-Line Dredge Rigged Up on Canal Job

SWEEPING submarine excavation in the Hudson River, to insure the removal of all rock above the required elevation, has been done by means of a deck scow, 35 x 96 ft., rigged up for the purpose. The scow was fitted with two 30-ft. oak spuds 16 x 16 in., raised and lowered by independent spud engines. On it was mounted an Ohio revolving locomotive crane, having a 65-ft. boom and a 1-yd. Williams clamshell bucket. The crane was so placed that it could excavate from either side or over the stern. A steel rail was suspended from the scow at the grade-line elevation. On the forward part of the deck was a double-drum hoisting engine, with 2000 ft. of ⅝-in. steel cable. For sweeping, this hoisting engine had the ⅝-in. cable led out on each side of the scow to an anchor, and a 1¼-in. line led over the bow to a kedge anchor. The scow was drawn back and forth over the canal prism by the hoisting engine, and it was dropped down the channel by slacking off the bow line.

When a high point was encountered by the sweep rail the spuds were dropped to hold the scow, and a diver descended to locate the trouble. He then returned and directed the craneman in lowering the clamshell bucket to remove the obstruction. The material excavated was loaded on the deck, which had been fitted with coamings so as to give a capacity of 100 cu.yd. When the scow had a full load it was towed to the spoil bank and unloaded by the clamshell bucket.

This scow and crane were used also in building wash walls and in placing riprap along the canal. The tool proved useful, too, in excavating under bridges and high-tension electric cables when the clearance was insufficient for a dipper dredge and in gravel and soft, mucky blue clay.



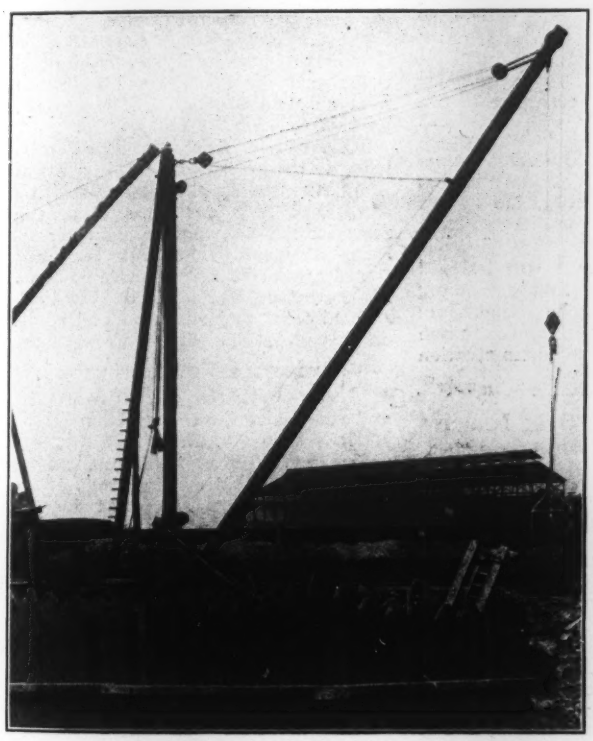
DRAG BOAT SWEPT FOR HIGH SPOTS WITH RAIL, DUG THEM OUT AND LOADED SPOIL ON FORWARD DECK

On the same work a drag-line dredge was improvised. Two steel pontoons, 75 x 15 ft., were placed together and a Monighan drag-line excavator was carried between them on a framing of 20-in. I-beams 30 ft. long. The pontoons had 25-ft. steel spuds, 20 x 20 in., operated by independent spud engines. With a 65-ft. boom handling a 3-yd. bucket, the machine could make a 50-ft. cut. The A-frame and boom could be lowered easily to permit the machine to pass under the numerous bridges and cable crossings encountered.

These machines were used on the canalization of the Hudson River for the Champlain Canal, near Waterford, N. Y. The use of a dumping basin and drag-line excavators on this same work for handling spoil delivered by dump scows, was described in *Engineering News-Record* of Oct. 25, p. 809. The work is being done by the Dunbar & Sullivan Dredging Co. Buffalo. R. H. Goode is superintendent.

Shape Tops of Wood Piles So Steam Hammer Will Take Two at Once

IN DRIVING a cofferdam of 6 x 10-in. wood sheeting for the foundations for a pumping plant to supply with water the extension of the Trumbull Steel Co.'s plant at Warren, Ohio, described on page 73, the Dravo Contracting Co. shaped the heads of the piles as shown in the photograph so as to reduce greatly time and breakage in driving. Two adjoining piles were trimmed



PILES DROVE WITHOUT SPLITTING

on opposite sides, so that when placed together the upper end of the pair would form a round butt which would fill the hood of a Vulcan steam hammer, leaving a flat place on top the size of the dolly plate.

The sheeting, which was made of solid timbers, splined, was easily driven, two pieces going down together about as fast as one driven alone. The time required for hammering in the sheeting was thus cut virtually in two, as is commonly done by driving two or more piles at once in placing steel sheeting. As shown in the photograph, the top of the cofferdam resulting from this process was very even, none of the piles being split or driven out of line. The driving was through clay and gravel, and a jet was not used.

Men Like Y. M. C. A. in Ohio Construction Camp

BY GEORGE W. MCALPIN
Government Dam No. 33, Maysville, Ky.

WHILE army Y. M. C. A. work is being brought so forcibly to the public attention, it is interesting to note the experiment conducted during the past construction season by the Bates & Rogers Construction Co. on its work at Lock and Dam 33, Ohio River.

Lock and dam work does not, as a rule, appeal to the common laborer, for he is continually worrying about the possibility of having to work in mud or water, as well as imagining numerous dangers which do not exist. Due to these fancies, as well as to the high wages paid on the construction of the army cantonments, it has been very difficult to keep laborers on the job during the past season. In order to make the men feel more at home and to induce them to stay, a Y. M. C. A. plan was adopted.

A secretary loaned by the association, whose salary was paid by the contractor, had charge of the work. An old bunkhouse was transformed into a clubhouse. Bunks, etc., were moved out and in their place came chairs, tables, reading stands and book shelves. Cards, checkers and other games, as well as quite a few books and magazines, helped to furnish amusement and recreation for the men. A phonograph proved popular, while an old moving-picture machine, repaired and operated by one of the men, was used in giving shows three nights each week. Films were secured from a nearby town at small cost. A tennis court was marked off as well as a ball field. The ball game, played with an indoor ball and bat, at noon time or between shifts, proved popular, virtually every man in camp taking part at one time or another.

On Sundays, services were conducted both morning and evening by the Y. M. C. A. man in charge. Occasionally, a speaker from a nearby town would volunteer to address the men.

While it is hard to say whether the experiment has proved a decided success, due to the short time that has elapsed since it was made, and to the unusual labor conditions in the country, still, judging from the number of men that took part in the games and attended the services, it must have had some good effect. Men get lonesome when in construction camps as well as when in army camps, and a book to read, a game of cards or a moving picture may leave a man in a more contented frame of mind than merely sitting around and waiting for bedtime. It is hoped the experiment can be repeated next season so that its effects can be more thoroughly studied.

Chicago Boulevard Extension To Be Pushed

Court decision in a condemnation suit clears the way for Chicago's extension of Michigan Ave. to connect the north and south boulevard systems, including a double-deck bascule bridge across the river. The short, narrow section of Michigan Ave. south of the river will be widened to 127 ft. and the extension north of the river will be 141 ft. wide. Work will be commenced as soon as possible. It is under the direction of the Board of Local Improvements, and is estimated to cost about $10,000,000.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Water-Power Legislation -Urged by President

Bill To Be Introduced in Lower House Creates Commission of Three Cabinet Members

At a conference held at the White House, Jan. 4, President Wilson urged on congressmen interested in pending water-power bills the need of prompt and united action to secure effective legislation at the present session of Congress. In order to end the deadlock which has existed between the advocates of various bills now pending, an entirely new bill has been prepared by direction of Secretaries Baker, Lane and Houston, and this bill creates a water-power commission made up of the cabinet officers named.

LICENSES FOR FIFTY YEARS

This commission is given authority to grant licenses for the use of water power on public lands as well as upon navigable streams for a term of 50 years. The commission is to have an executive officer, who is to be appointed by the President for a term of five years. The commission has authority to provide a franchise for the payment of rentals, and to fix all other terms in connection with the conditions under which the development shall be made.

At the end of the 50-year term, the commission may either continue the licensee in possession of the property, or it may issue new licenses under laws at that time applicable. If a new licensee receives the property, he must pay to the original licensee the fair value of the property, or if the Government takes the property over it must pay a fair value. This fair value is defined as including all physical property and main transmission lines, plus severance damages for any property which is not taken over and which is damaged by reason of severance. The licensee is, however, to receive no allowance for increased land values, for water rights or for any good will or value due to its operation as a going concern.

CONGRESS MAY AMEND, ALTER OR REPEAL

The bill reserves the right to Congress to alter, amend or repeal the rights granted by the Water Power Commission, but it may not thus alter, amend or repeal franchises where the grantors have already exercised the rights granted of expending money.

The committee which drafted this bill was made up of Gen. William M. Black and Colonel Keller, of the Corps of Engineers, representing the War Department; Maj. E. C. Finney, member of the Institute of Electrical Engineers, who is acting as a water-power expert for Secretary Lane, and former Representative Lathrop Brown, of New York, who is now a special assistant to Secretary Lane. The Department of Agriculture was represented by O. C. Merrill, chief engineer of the Forest Service.

At the White House conference it was announced that the administration bill will be introduced into the House by the Rules Committee, which may report a special rule requiring action within a limited time upon the bill. In order to otain harmony, if possible, between the advocates of other pending bills and their coöperation in support of the administration bill with possible amendment, a committee of fifteen, made up of five members from each of the House Committees on Interstate and Foreign Commerce, Agriculture, and Public Lands, is created.

The Senate passed the Shields water-power bill on Dec. 14, and it is less certain that the administration ill will have plain sailing in the Senate. It is expected, however, that another White House conference will be held of senators interested in the pending water-power bill, in the hope that there also it may be possible to secure united action in favor of the administration bill.

Government Takes Over Niagara Power Plants

On Dec. 28 the Government requisitioned the electric power produced, imported and distributed by the Niagara Falls Power Co., the Hydraulic Power Co. of Niagara Falls and the Cliff Electrical Distributing Co. Disposition of the power and rules regarding its use are not yet decided upon, pending an investigation of the power and fuel situation in and around Buffalo by Robert J. Bulkeley, who is connected with the War Industries Board, and Col. C. Keller, U. S. Army, of the Chief of Engineers' Office in Washington.

Highway Traffic Association Meeting

A public meeting of the Highway Traffic Association of the State of New York will be held in the assembly hall of the Automobile Club of America, 247 West 54th St., New York City, on Tuesday evening, Jan. 15. Roy D. Chapin, chairman of the Highways Transport Committee of the Council of National Defense, will speak on the work of his committee, and the topic for general discussion will be "Practical Methods of Relieving Terminal Freight Congestion in New York City."

Government Housing Plans Are Progressing

Letter from Chairman Hurley Shows That Much Work Has Been Done

Just what the Government intends to do toward providing homes for the thousands of workers who cannot be accommodated normally near the new and enlarged war industries has not yet been definitely announced or possibly even decided upon. An indication of the progress which has been made and the developments in one field, that of shipbuilding, may be had from a recent letter of Chairman Hurley, of the Shipping Board, to Senator Fletcher, Chairman of the Committee on Commerce, explaining the request of the Board for $35,000,000 for houses near shipyards. Mr. Hurley wrote in part as follows:

"One of the most perplexing problems of the war to the United States Shipping Board, the army, and the navy, has been the lack of housing facilities for the enormously increased army of labor. The War Industries Board appointed a Committee on Housing, with Otto M. Eidlitz, of New York, as chairman, to investigate and advise on this situation.

INVESTIGATED BY COMMITTEE

"This committee has investigated and advised on the immediate necessity of increasing housing facilities, but owing to the fact that this problem had not yet reached a critical stage at the time Congress adjourned at its last session, and that no request had been made to Congress for an appropriation to provide necessary houses, Mr. Eidlitz was unable to do more than suggest.

"The Shipping Board also had appointed an advisory committee which thoroughly investigated housing conditions at the shipyards and recommended some action toward relieving the situation, but all committees were more or less handicapped by no special financial provisions for taking care of this unlooked-for situation.

CONSTRUCTION BEGUN AT ONCE

"In November I appointed J. Rogers Flannery to see what could be done to help the housing troubles at the shipyards. The demand for immediate action became so apparent, when the situation was thoroughly investigated, that the Shipping Board decided to start construction at once at the most critical points. Hog Island will be the largest operation, and $10,000,000 has been set aside for the erection of thousands of houses to be erected in the vicinity of the Hog Island shipyard.

Bristol, Penn., has also been assisted, and a large community site is being constructed.

"Sparrows Point, Md., has been in need of housing facilities, and the Shipping Board is helping the Bethlehem Shipbuilding Corporation, Ltd., to purchase about 400 five- and six-room brick houses to care for the shipyard employees. Baltimore, which is about ten miles from the shipyards, is coöperating with the United States Shipping Board to the fullest extent, and is giving invaluable assistance in helping to place the shipyard employees in homes, rooms, and apartments.

"Chester, Penn.; Wilmington, Del.; Newport News, ,Va.; Newburgh, N. Y., and many other shipbuilding points are being investigated, and plans are under consideration for alleviating the housing situation.

"We are treating the housing proposition from a very broad viewpoint, and in all cases where community sites are being planned are providing all the social, moral and artistic features that will add to the social, moral and physical wellbeing of the shipbuilding employees, who will live in these communities. While protecting the investment of the Government, we are also adjusting the rents, purchase terms, etc., on such a basis that they will be within normal reach of the men who will occupy these houses.

SHIPPING BOARD'S PROGRAM

"The Shipping Board has invited the Committee on Housing to act as its advisory committee, has provided quarters for and is paying all salaries and clerical expenses of this committee and is attempting to work out this housing problem along the very broad lines that it deserves, hoping that Congress will realize the necessity of providing the necessary appropriation with which to take care of the housing necessities of all branches of the Government.

"The Shipping Board is building up this housing organization in conjunction with the Committee on Housing, so that no time may be lost, and when Congress decides to appoint an independent housing commission with the necessary appropriation to take hold and construct the necessary housing for all branches of the Government, standard town plans will have been laid out and standard types of houses that will permit of standard dimension parts and standard materials will have been decided upon. Everything will be ready. All preliminary foundation work will have been completed. Immediate action can be assured."

New York War Port Board Elects New Chairman

E. N. Hurley, chairman of the Shipping Board, was elected head of the War Port Board of New York on Jan. 7, succeeding Secretary McAdoo, who was forced to give up the place because of the pressure of work entailed by his new office of Director of Railroads.

After the meeting of the board in Washington, Irving T. Bush, the executive officer, conferred with Secretary Baker and Major General Black in regard to the storage of ammunition around New York Harbor. Mr. Baker later announced that a project was being worked out which would insure safe storage of explosives, but that he was not ready to make the plans public because the acquisition of certain lands was involved.

Priority Order No. 2 Suspended

Lovett Issues Manifesto Allowing Resumption of Road Work—Quickly Follows Government Control of Rails

As an expected aftermath to the President's taking over of railroad lines on Dec. 26, Robert S. Lovett, administrator of priority and transportation, issued a general suspension order, taking effect midnight of Dec. 31, which affected all priority orders which had been issued. This rescinding of orders will hold until further notice, but it is expected that the centralized control of the railroad lines will make another general reversal improbable.

The significance of Government control was pointed out in two editorials in *Engineering News-Record* of Jan. 3, p. 4. The possibilities of economizing facilities, and so increasing the efficiency of the roads that all necessary present traffic can be handled will no doubt have a direct effect upon the resumption of highway construction. This, in turn, is expected to do much toward further increasing the capacity of our railroad system and making our war-time preparations more speedy and effective.

Attention is called to an editorial on p. 59 of this issue, which points out the recent development in the Government's attitude toward transportation. Highway officials all over the country have been anticipating this action, and are already preparing plans for the vital and important highways that will be constructed this year between important industrial centers, and as extensions to terminal facilities—the last affording opportunity for the delivery of freight from factories or warehouses to switches outside of yard limits which may be reached by motor truck over well-paved roads.

Taken in connection with the new order from Secretary McAdoo, raising the demurrage charges on freight cars, the recent actions of the Government should prove an immediate and effective remedy for the congestion which has been scuh an impediment to our preparations and the cause of so much worry, and distress to those who saw the necessity of dispatch and efficiency, as well as to the populations of cities which required an even movement of freight for the very necessities of their existence.

The Highway War Board, together with the Office of Public Roads and various state highway departments, should now be able to proceed with a logical, consistent and defensible program of road construction. The general attitude of highway engineers is that the new problems in road building must go further than a mere consideration of the engineering in connection with the preparation of foundations and wearing surface. Many are at the present time making a special study, not of these features, but of the general questions of transportation upon which the construction of roads for the next year must turn. From all indications, the breaking up of winter will witness an encouraging resumption of highway construction.

Goethals Heads Army Transportation

On Jan. 7 Secretary of War Baker took one step farther toward the centralization of activities in his department by naming Maj. Gen. George W. Goethals Director of War Department Transportation and Storage.

General Goethals, as Acting Quartermaster General, directs the supply, subsistence and pay departments of the army, supplemented by the embarkation and other services already established in his office, each with a general officer in charge. Under the new order he will, in addition, supervise transportation of all ordnance, engineers, signal corps, aviation service and coast artillery material, as well as quartermaster supplies and troops.

All bureaus heretofore independent in this regard have been directed to coördinate their demands upon the railroads and upon storage facilities through the Director of Transportation. He, in turn, will deal with the Director of Railroads, the Shipping Board or any other centralized agency for transportation or storage, presenting complete schedules of cars and tonnage needed and working out routing and storage so as to get the most efficient use of the nation's facilities.

Engineering Profession Ignored in Service Board Appointees

F. J. H. Kracke and Charles B. Hubbell have been named by Governor Whitman of New York to fill the places on the Public Service Commission, First District, made vacant by the resignations of Col. William Hayward and Lieut. Col. Henry W. Hodge, both of whom left office to join the United States Army. Mr. Kracke, a Brooklyn politician, has been commissioner of plant and structures for New York City under the recent Mitchell administration. Mr. Hubbell is a member of the state Commission on New Prisons and former president of the New York City Board of Education.

Engineer Officers Raised to Rank of Brigadier Generals in National Army

BRIG. GEN. CLEMENT A. F. FLAGLER

BRIG. GEN. EDGAR JADWIN

BRIG. GEN. W. W. HARTS

Langfitt Promoted to Rank of Major General, and Rees, Harts, Flagler and Jadwin Become Brigadiers

The higher officers in the Corps of Engineers, U. S. Army, are gradually being promoted to general commands in the National Army. In the latest Presidential orders five engineers are promoted, four to be brigadiers and one to be a major general.

The new major general is William C. Langfitt, who was made a brigadier early in the war. General Langfitt was graduated from West Point in 1883, and after the usual station duty of the younger engineer officer took command in 1898 of the engineering work of the army in Hawaii. From 1899 to 1905 he was on the Pacific Coast, and in 1905 and 1906 in command of the engineer post and school at Washington. In October, 1906, he went to Cuba as chief engineer on the staff of General Barry, returning in August, 1907, to the engineer post and school at Washington. From 1910 until our entry in the war he was in charge of various engineer offices throughout the East. He was in command of one of the first railway regiments which went to France. General Langfitt's photograph was reproduced in *Engineering News-Record* of May 24, 1917, p. 429.

The new brigadiers, all promoted from colonels of engineers in the regular army, are Thomas H. Rees, Clement A. F. Flagler, W. W. Harts and Edgar Jadwin. General Rees has recently been in command of an engineer regiment in the Philippines after being on station in San Francisco, where he was chairman of the California Débris Commission. General Flagler's most recent assignment was in charge of the Washington district, which included the aqueduct and the new Key Bridge. General Harts has been Superintendent of Public Buildings and Grounds at Washington and the military aid of President Wilson for some years, but at his own request was assigned early in the war to active duty in command of one of the engineer regiments.

General Jadwin went to France early in the war in command of one of the military regiments.

Opportunities for Engineers Outside Army and Navy Reserve Corps

In *Engineering News-Record* last week attention was called to the fact that the Engineer Officers' Reserve Corps of the army and the Civil Engineer Officers' Reserve of the navy were at the present time filled and that there is no demand from Washington for candidates for commissions in either of these corps.

At the same time it should be pointed out that there are certain opportunities for engineering service in the ordnance and signal departments of the army, both of which are commissioning a few engineers. Neither of these branches, however, has a special engineers' reserve, nor has either yet conducted a public campaign among engineers for candidates for commissions; but the Ordnance Department has recently established in the office of the American Society of Mechanical Engineers at New York City a board of officers for the purpose of examining candidates for commissions and is particularly anxious to obtain men familiar with the manufacture, construction and repair of ordnance material. The Quartermaster Corps has had a number of construction engineers commissioned to work on the various cantonments, warehouses, etc., but there is apparently no demand for any more.

The Signal Corps, too, has a few structural men for its construction program, but the demand for engineers outside of the Corps of Engineers is mainly for those of mechanical training and more particularly with machine shop or manufacturing experience.

Engineers who might qualify for such appointments and all other who desire to offer their technical services to the Government can register in the U. S. Public Service Reserve, which is a branch of the Department of Labor, having its office at 1712 I St., Washington, D. C. On writing to this office an applicant will be instructed to fill out blanks which will put on record his experience and qualifications. Thus there is gradually being built up a list in Washington to which both the military and civil departments are turning to fill vacancies or new positions. Registration in the Public Service Reserve does not bind a man to any service, nor does it guarantee to find a place for any applicant. It does bring together the man and the position.

Want More Road Builders To Serve with Forestry Regiment

There is immediate need, according to an announcement sent out by Major General Black, Chief of Engineers, for 3000 additional enlisted men, experienced in road and bridge construction, to form auxiliary units required for

service in France with the 20th Engineers or Lumbermen's Regiment now being assembled at Washington, D. C. Laborers, motor truck drivers, operators of road machinery, bridge carpenters and men skilled in road construction are wanted.

Previous military training is unnecessary. Men should apply at once, stating their experience in full, to Maj. H. F. Bowlby, Office of the Chief of Engineers, Room 25, War Department, Washington, D. C. Not only men from 18 to 21 and from 31 to 41 can volunteer, but those within the draft law having the special experience required, and not having been called, can be inducted into service and assigned to the regiment by their local draft boards, after their applications, directed to Major Bowlby, have been approved.

The regiment is stated to be fully officered.

Engineers May Register for Public Service

The United States Public Service Reserve, a branch of the Department of Labor, with headquarters at 1712 I St., N.W., Washington, D. C., is compiling a list of qualified men in all branches of activity for war work under the Government. It is particularly desirous of registering engineers who are willing to accept positions in Government service or commissions in the army or the navy. Under date of Dec. 28, it issued a special appeal to such engineers. While it is the opinion of *Engineering News-Record* that the tone of this appeal is unduly optimistic as to the applicants' chances of receiving commissions in the military forces, the text is printed below with that reservation only:

"The Army and Navy staff departments continue to demand men of engineering experience, especially in industrial lines. At present the outlook is that this demand will continue throughout the period of the war.

"In calling attention to this, the United States Public Service Reserve, Washington, D. C. (where records of men willing to serve when called will be kept on file), points out that a man of engineering experience has a rare combination of opportunities open to him, which are not open to the average patriotic American, as follows:

"1. To serve the country in his most effective capacity.

"2. To keep in touch with his own profession, with the result that his patriotic service will not have caused him to become rusty by the time peace returns.

"3. To become a commissioned officer and receive much better pay than the average man who has wholly subordinated personal interests and now works for the national good.

"4. To perform his service usually without leaving the United States."

Those writing to the Washington office will be asked to fill out blanks registering qualifications, but will not be obliged to accept positions.

Governor Whitman Would Sell State's Water Power

In Annual Message New York Executive Urges Laws Enabling State To Develop Power

In his annual message to the Legislature, Governor Whitman of New York brings to the attention of that body the need of modern water-power legislation, to permit a proper use of many of the water resources of the state, with an equitable return to the state. Some of the pertinent paragraphs of the message are as follows:

"For several years past there have been endeavors to formulate a policy for the conservation of the water powers of the state, but as yet no adequate solution of this problem has been found. I am convinced that now is the time for the adoption of a policy that will enable the state not only to develop these natural resources but also to derive a substantial revenue therefrom.

"It was the practice in the past to grant to individuals, by private bills, the right to use the water powers of the state without consideration. Thus properties of inestimable value, formerly the property of all the people of the state, by reason of such grants yield no income to the state, and frequently it has been necessary for the state to reclaim at an enormous expense the property granted by these private bills.

Electric Power Urgently Needed Now

"Never before has the need of electric power been so urgent as it now is and will continue to be, not only for the period of the war but thereafter. We need the development of the vast natural resources of the state to win the war as well as to win in the commercial strife that will inevitably follow.

"Under the present laws, the state is prohibited from disposing of any surplus waters created by the canal improvement. The surplus power created accidentally by the construction of the canal is now being wasted. The increasing cost of maintaining our state government is a continuing serious problem, and the direct revenue of the state can be increased without appreciable expense to it by leasing the surplus waters.

"Realizing the importance of this question, I requested the State Engineer, the Attorney-General, the Superintendent of Public Works and the Conservation Commissioner to study the question and to report to me their conclusions and recommendations

"The recommendations of the committee are as follows:

"Your committee has decided upon submitting to you four suggestions, the first two of which, while concrete in themselves, necessarily have a direct bearing upon the third, and in the opinion of your committee should be effected in order to permit of a proper and certain accomplishment of the third suggestion.

"1. To amend the Constitution so as to take from the Legislature the power to grant away, by private bills, the water powers of the state.

"2. To repeal Article 7a of the Conservation Law which provides for river regulation by storage reservoirs.

"3. The immediate passage of appropriate legislation to enable the state to develop the undeveloped water powers of the state through a commission to be appointed by the Governor and to market the power thus developed under the direction of such commission.

"4. The immediate passage of appropriate legislation authorizing the Superintendent of Public Works, with the approval of the Canal Board, to dispose for proper returns by lease of surplus water created as a result of the construction of the Barge Canals."

Index to Vol. 79

The index to Vol. 79 of "Engineering News-Record," which closed with the issue of Dec. 27, 1917, will be found just before the back cover of this issue.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, 29 West 39th St., New York; Jan. 16 and 17, 1918, New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, 35 Nassau St., New York; Jan. 14, New York.

AMERICAN WOOD PRESERVERS' ASSOCIATION; Baltimore, Md.; Jan. 22-24, Chicago.

CANADIAN SOCIETY OF CIVIL ENGINEERS; Montreal; Jan. 21-23, Montreal.

AMERICAN INSTITUTE OF MINING ENGINEERS, 29 West 39th St., New York; Feb. 18-21, New York.

AMERICAN CONCRETE INSTITUTE; 27 School St., Boston; Feb. 7-9, Chicago.

Edmund F. Perkins, consulting engineer, Chicago, president of the American Association of Engineers, will address the New York Chapter at the Hotel McAlpin, on Jan. 15, at 8 p.m. His subject will be, "National Asssociation Service for Engineers."

The Oregon Society of Engineers, in connection with the extension department of the Oregon Agricultural College, is giving courses in thermics, engineering mathematics and structural

engineering. These courses lead to advanced degrees in the college. The annual meeting of the society will be held at Portland, Feb. 4. H. L. Vorse is president and Orrin S. Stanley is secretary.

The Western Society of Engineers has elected the following officers, who will be installed at the annual meeting Jan. 24: President, Charles B. Burdick; vice presidents, James N. Hatch, Kempster B. Miller and A. S. Baldwin; treasurer, Carlton R. Dart; trustee for three years, Wilford W. DeBerard.

The Oklahoma Society of Engineers at its recent annual meeeting passed a resolution in favor of more good roads and more Federal aid for such roads. It also appointed a committeee to present to the next legislature (in 1919) a revised road law providing especially for efficiency in the construction of permanent roads. The society has proposed an amendment to the law governing irrigation and reclamation work, and this has been indorsed by the Oklahoma Chamber of Commerce. Max L. Cunningham, state engineer, was elected president for 1918; H. V. Hinckley, Oklahoma City, Okla., is secretary and treasurer.

The Cornell Society of Civil Engineers will hold a war-time dinner in New York on Jan. 18, during the annual meeting of the American Society of Civil Engineers. The dinner, which will be conducted in strict accordance with the wishes of the Food Administration, will be held at the Cornell University Club, 65 Park Ave. A number of short talks on the work of the engineer in the war will be given by officers and civilians who are connected with such work.

The Canadian Society of Civil Engineers will hold its regular meeting tonight at Montreal. The subject of the evening will be a talk on "Notes on the Tendered Design of the St. Lawrence Bridge Co.," the fourth of a series of illustrated lectures on the Quebec Bridge. The speaker will be G. H. Duggan, past president of the society and chief engineer of the bridge company.

PERSONAL NOTES

WILIAM J. BATHRICK has been appointed city engineer of the City of Imperial, Calif., to succeed JOHN T. RICE, resigned.

ERNEST S. DRAPER has been appointed engineer of structures, Boston & Albany R.R., with headquarters at South Station, Boston, succeeding Albert D. Case, resigned.

L. CLAPPER, who was formerly assistant engineer on the Duluth & Iron Range R.R., has been appointed engineer of bridges and buildings. He takes the place of B. T. MCIVER, formerly general foreman of bridges and buildings, who has resigned.

THE SOLOMON-NORCROSS CO., consulting engineers, Atlanta, composed of P. H. NORCROSS and G. I. SOLOMON, has recently been appointed to act as supervising and consulting engineer on the work of erecting an additional army cantonment to be built at Belvoir, Va. The company has been engaged in similar work for the Government, at various places, since April.

C. E. EDWARDS, of the U. S. Reclamation Service, has been promoted to maintenance engineer. He is stationed at Sunnyside, Wash., and is in charge of the maintenance and betterment work on the Yakima-Sunnyside Irrigation project.

DELMAR E. TEED, formerly consulting engineer at Cadillac, Mich., is now chief engineer of the Tennessee Valley Iron & Railroad Co., Pittsburgh. Mr. Teed is a former president of the Michigan Engineering Society.

MAJ. S. F. CRECELIUS, Engineer Officers' Reserve Corps, has been ordered to the 101st Engineers, American Expeditionary Force.

ARTHUR TAYLOR, engineer and superintendent, Imperial Water Co. No. 3, Imperial Valley, California, has been commissioned first lieutenant in the Engineer Officers' Reserve Corps and has been ordered to Camp Lee, Petersburg, Virginia.

NELSON TAYLOR, formerly of Los Angeles, Calif., is now Lieutenant Taylor, U. S. N.,, on the U. S. S. Bridgeport.

CAPT. FREDERICK MEARS, U. S. Army, member of the Alaska Engineering Commission, at Anchorage, Alaska, has been promoted to the rank of major in the regular army.

E. S. JACCARD, chief draftsman of the Alaskan Engineering Commission, at Anchorage, Alaska, has been appointed office engineer.

GEORGE CALDWELL, assistant superintendent of construction on the Seward division of the Alaskan Government Railways, has been appointed assistant engineer.

ROY COLEMAN, connected with the Pennsylvania R.R., Trenton Division, in the capacity of civil engineer, has enlisted in the engineering corps, U. S. Army, and will be stationed at Augusta, Georgia.

EDWARD M. MYERS became city manager of Gallipolis, Ohio, on Jan. 1, when a commission-manager charter went into effect. He was formerly sheriff of Gallipolis.

JOHN T. WHISTLER has been transferred from the U. S. Reclamation Service to the Federal Farm Loan Bureau and is now engineer-adviser on irrigation and drainage matters, with office in Denver, Colo. Mr. Whistler was until recently project manager on the Truckee-Carson project, with office at Fallon, Nev., and engineer-in-charge of Colorado River basin investigations.

BION J. ARNOLD, consulting engineer, Chicago, recently commissioned lieutenant colonel in the aviation section of the Signal Corps, has been ordered to France.

G. R. MCLEOD, who has been in charge of the sewers department of the city engineers' staff at Montreal, has gone to Washington as a member of the Imperial Munitions Board. E. FUSEY, assistant engineer, has been named for Mr. McLeod's place.

MILO S. KETCHUM, dean of the college of engineering in the University of Colorado and president of the Society for the Promotion of Engineering Education, has been in Washington conferring with the War Department concerning the furloughing of engineering students. Dean Ketchum will make addresses in January before engineering and scientific organizations in Kansas and Nebraska.

W. L. HEMPHILL, former U. S. surveyor, Boise, Idaho, has been commissioned a captain in the field artillery section of the Officers' Reserve Corps and assigned to active duty with the Second Motor Company of the 316th Ammunition Train at Camp Lewis, Washington. Mr. Hemphill is a graduate engineer of the Citadel at Charleston, S. C., a War Department Honor School, and for the past thirteen years has been doing engineering work in the United States, the Philippines, Bolivia, Chile, Guatemala and Spain.

ARTHUR B. SMITH, district engineer, with the Los Angeles County, California Road Department, has been commissioned as lieutenant in the Engineer Officers' Reserve Corps, and has been assigned to the Engineer Officers' Training School at Camp Lee, Petersburg, Virginia.

JOHN SESSER has been appointed assistant general superintendent of the Great Northern Ry., advancing from the position of superintendent, with headquarters at Whitefish, Mont., which position he had held since July, 1913. Mr. Sesser was born in St. Joseph, Mich., in 1873, and was graduated from the civil engineering course at Lehigh University it 1896. After service with the Chicago & Northwestern Ry., the Union Pacific System, the Chicago, Milwaukee & St. Paul Ry. and the Chicago, Burlington & Quincy R.R., he entered the employ of the Great Northern as trainmaster in 1909, becoming assistant engineer maintenance of way the following year.

NELSON B. HUNT has been transferred from the position of chief draftsman in the office of the U. S. Surveyor General for Washington, at

Olympia, Wash., to draftsman on detail work in the office of J. L. Savage, designing engineer for the U. S. Reclamation Service, at Denver.

WILLIAM D. UHLER, chief engineer of the Pennsylvania State Highway Department since Apr. 7, 1915, has been commissioned a major in the Ordnance Reserve of the United States Army. As provided for in the act approved June 7, 1917, he has requested leave of absence from his duties, which request has been granted by Governor Brumbaugh. Mr. Uhler is president of the American Association of State Highway Officials, having been elected at the recent meeting in Richmond, Virginia.

S. H. OSBORNE, formerly assistant engineer on special assignment in the maintenance-of-way department of the Union Pacific System, with headquarters at Omaha, has been appointed division engineer of the Kansas division, with headquarters at Kansas City, Mo., vice G. F. MAITLAND, resigned.

W. E. BURKHALTER has been appointed acting division engineer of the St. Louis division of the Mobile & Ohio R.R., with headquarters at Murphysboro, Illinois.

FREDERICK McQ. FALCK is the new general manager of the Philadelphia & Reading Ry., promoted from the post of assistant general manager. Mr. Falck reached the latter office last April, when he was advanced from the position of superintendent of the Atlantic City R.R. and superintendent of the Delaware River Ferry Co. He has been with the Philadelphia & Reading Ry. since 1898, four years after his graduation from Cornell. He began his railroad work as an assistant supervisor.

JOHN LOWE has been appointed chief engineer and general superintendent of the San Diego and Easton Ry., San Diego, Calif. For a number of years prior to this appointment he was with the engineering department of the Pacific Electric Ry. at Los Angeles.

RICHARD G. WILLIAMS, until recently assistant engineer with the New York State Highway Commission, is now second assistant division engineer, Wisconsin Highway Commission, with headquarters at Green Bay.

E. W. PITTMAN, for the past seven years manager of the Pittsburgh plant of the McClintic-Marshall Construction Co., has resigned to enter the employ of the John Eichleay, Jr., Co., Pittsburgh, as chief engineer and manager.

JOHN HAYES SMITH, consulting engineer, Milwaukee, has closed his office to accept a position as assistant engineer to the Public Service Commission of Pennsylvania. Mr. Smith is a graduate of Cornell University. He associated himself with the Westinghouse Electric and Manufacturing Co. shortly after graduation, remaining in its employ about six years. He was the first manager of the *Electric Journal*, Pittsburgh. Resigning this position, he became editor of the *Electrical Age*, New York, for four years. Since that time Mr. Smith has been in Milwaukee. For two years he was with the Milwaukee Electric Railway and Light Company.

A. A. CULP has succeeded C. A. REDINGER as resident engineer of the Southern Ry. at Selma, N. C., Mr. Redinger having received a leave of absence.

R. HAYES, who has been resident engineer of the Southern Ry. at Alexandria, Va., has been advanced to structural engineer in the office of the assistant to the vice president of the railway, Washington, D. C. He succeeds P. B. LUM, resigned.

W. F. McDADE has resigned as division engineer of the Southern Ry. in Mississippi, with headquarters at Columbus, Miss., and has been succeeded by C. U. IRVINE.

F. W. WINTER and C. E. MYERS, assistant engineers of the State Highway Department, Harrisburg, Penn., have been commissioned captains in the U. S. Army Engineer Reserves.

HARRY C. VAN EMBURGH, North Plainfield, N. J., has been re-elected engineer for the city.

H. S. MORSE, engineer of the Bureau of Governmental Research, Detroit, Mich., since 1916, has been appointed director of public service, Akron, Ohio. He will assume office on Jan. 14.

SHELBY S. ROBERTS, Transportation Building, Chicago, will henceforth carry on the consulting engineering business of Berry & Roberts, that firm having been dissolved.

R. E. WOODRUFF, until recently superintendent of the Mahoning division of the Erie R.R., has been appointed superintendent of transportation of the road. Mr. Woodruff was graduated from Purdue University in 1905, and in the same year entered the service of the Erie as a track laborer. He advanced through the grades of foreman, transitman, assistant division engineer and trainmaster to the position of division superintendent at Rochester, N. Y., reaching that position in 1910.

W. W. MATHEWS, formerly with Alvord & Burdick, consulting engineers, later with the Sanitary District of Chicago, and the Grace Contracting Co., is in the aviation school at Grantham, Lincolnshire, England. His address is, care of the American Embassy, London. In a recent letter he says that the flying schools are crowded and that he is still on ground work, although he completed his course at Urbana, Ill., previous to embarkation.

MAJ. DONALD M. SAWYER, constructing quartermaster in charge of the construction of the Camp Grant cantonment at Rockford, Ill., has been made supervising constructing quartermaster in charge of the construction of warehouses.

W. H. KIRKBRIDE has been appointed assistant superintendent of the Sacramento division of the Southern Pacific System, advancing from the post of division engineer of the division. He entered the employ of the system in 1902 as assistant engineer.

THOMAS K. A. HENDRICK, until recently instructor in physics and higher mathematics at Mount St. Mary's College, Emmitsburg, Md., has been commissioned second lieutenant in the Coast Artillery Reserve Corps and is now with the American expeditionary forces.

E. KEMPER CARTER, representative of the Standard Asphalt and Refining Co., Chicago, has received a commission as captain in the Engineer Officers' Reserve Corps.

S. J. BELL, formerly engineer in the bridge department of the Union Pacific System, at Omaha, is now with the Iowa State Highway Commission at Ames, Iowa.

WALTER B. BREDBECK, engineer in the bridge department, Union Pacific System, at Omaha, is now a first lieutenant in the Engineer Officers' Reserve Corps.

A. N. KRIEGER, structural designer with the H. Koppers Co., Pittsburgh, is now in Chicago as assistant in the designing of two benzol plants for the People's Gas Light and Coke Company.

DOUGLAS LEARD has been appointed right-of-way engineer, Seaboard Air Line Railway Co., vice I. H. FARMER, who has entered military service.

C. H. ANDREWS, assistant to the president and chief engineer of the North Carolina Public Service Co., Greensboro, N. C., has been appointed general superintendent of the Southern Utilities Co., which operates electric gas and ice properties throughout Florida, under the management of the J. G. White Management Corporation, New York.

J. H. COOPER has been made supervisor on the Pennsylvania R.R. at Phillipsburg, N. J., advancing from the position of assistant supervisor at Tacony, Penn. He succeeds WILLIAM DEK. SMITH. Mr. Cooper, who is a graduate of Lafayette, entered the service of the Pennsylvania R.R. as a rodman in 1905, soon after his graduation from Lafayette College.

OBITUARY

CHARLES MULFORD ROBINSON, Rochester, N. Y., one of the leading city planners of the United States in point of time, amount and character of work, and professor of civic design at the University of Illinois since 1913, died from pneumonia in Albany, N. Y., Dec. 30. He was born in Ramapo, N. Y., in 1869 and was graduated from the University of Rochester in 1891. He was the first secretary of the American Park and Outdoor Art Association, 1902-04, the first secretary of the American Civic Association and the first professor of civic design in an American college. He held editorial positions on several dailies, and was contributing editor of the *Survey* and *Architectural Record*. He was author of "The Improvements of Towns and Cities" and "Modern Civic Art," pioneer American books on city planning. He wrote also "The Call of the City" and "The Width and Arrangement of City Streets." An enlarged edition of the latter appeared in 1916 with the title "City Planning, with Special Reference to the Planning of Streets and Lots."

HENRY A. HERRICK, who built the Black Eagle dam at Great Falls in 1890, died suddenly at Butte, Mont., Dec. 14, at the age of 61. Mr. Herrick was identified with the engineering features of virtually all of the dams built along the Missouri River by the Montana Power Co. or its predecessors in the past 27 years.

ALBERT BLAUVELT, associate manager of Western Factory Insurance Association, Chicago, died in Nashville, Jan. 4. He was a frequent attendant at conventions of water-works officials. He had been a member of the American Water-Works Association since 1909 and active in advocating the cause of fire prevention by an adequate water-supply.

JOSEPH S. SEWALL, city engineer of St. Paul, Minn., from 1876 to 1881, died in that city Dec. 22, at the age of 90 years. He settled in St. Paul in 1854 and constructed the Wabasha, Marshall Ave. and Old Fort Snelling bridges. He was an early member of the Western Society of Engineers, joining that organization in 1878. He retired from active work in 1890.

PROF. CLEMENT H. MCLEOD, vice dean of the Faculty of Applied Science of McGill University, Montreal, died Dec. 26. He was professor of geodesy and surveying, and had charge of the McGill Observatory. Professor McLeod was born at Strathlorn, Cape Breton, in 1851, and was graduated in applied science at McGill in 1873. His first engineering work was done in charge of section construction on the Intercolonial Ry., and he subsequently became resident engineer on construction of the Prince Edward Island Ry. and afterward engineer of public works, Newfoundland. He was appointed superintendent of McGill Observatory in 1874, and in 1888 became professor of applied science. Professor McLeod was the author of a number of textbooks. He was a charter member of the Canadian Society of Civil Engineers and served as secretary of that body for 25 years. He was a Fellow of the Royal Astronomical Institute and of the Royal Society of Canada, and a member of the American Astronomical Society.

TRADE PUBLICATIONS

The Builders Iron Foundry, of Providence, R. I., has issued a bulletin (No. 181) illustrating the use of venturi meters on sewage installations.

An illustrated folder showing Mack trucks of the smaller sizes (1-, 1½- and 2-ton), used in a wide variety of industrial service, has been issued by the International Motor Co., New York.

INDUSTRIAL NEWS AND COMMENT

Frank Lampson Brown Dead

Frank Lampson Brown, president of the Ransome Concrete Machinery Co., died at his home in New York, Jan. 1, from heart disease.

Mr. Brown headed the Ransome Concrete Machinery Co. for the past two years. For 15 years he was Pacific Coast manager of the American Steel and Wire Co. and its predecessor, the Washburn-Moen Wire Company.

He was one of the pioneers in the Great Western Power Co., the successful development of which is largely attributed to Mr. Brown's vigorous personality.

Mr. Brown was a member of the Lawyers' Club of New York, vice president of the Manufacturers' Export Association and chairman of the speakers' committee of the Rotary Club of New York. He was also a member of the Union League and Commercial Club of San Francisco and the California Society and Rocky Mountain Club of New York. He was born in Kenosha, Wis., in 1860.

For the purpose of organizing for war service, the American Hardware Manufacturers' Asssociation will hold a general meeting on Jan. 17, at 10 a.m., at the Biltmore Hotel, New York.

E. F. Houghton & Co., of Philadelphia, manufacturers of oils and leathers for the industries, announce the opening of a branch office at 432 Canal St., New York City, which will be in charge of T. C. Maxfield. Mr. Maxfield was formerly with the N. K. Bowman-Edson Co., New York representative of the Houghton line.

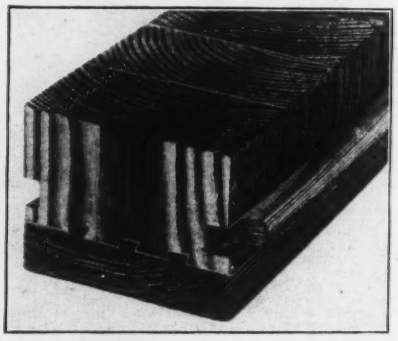
Every employee and official of the Parsons Co., Newton, Iowa, together with every member of every employee's family, was enlisted in the membership of the American Red Cross during the recent Red Cross "drive." This 100% membership campaign was conducted in two days, Dec. 27 and Dec. 28.

C. P. Coleman was elected president of the Worthington Pump and Machinery Corporation at a meeting of the board of directors held Monday, Dec. 31.

APPLIANCES AND MATERIALS

Vertical Grained Wood Block Units Form Floor

A wood block flooring of unique type, called "Bloxonend," is now on the market. It comes in units made up of vertical grained blocks dovetailed with a carrying board to insure a uniformly smooth wearing surface and prevent any block riding above or sinking below the level of the others. The blocks are made up in sections about 8 in. long by 3½ in. wide, and are laid exactly like any other 2-in. tongued and grooved plank floor would be laid, except that the floating type of floor rather than the fixed type is recommended. In other words, the blocks and their carrying board are nailed onto a grill of light 4 in. wide by ⅜-in. thick strips or boards, which are spaced 4 in. apart so that they have 4 in. of bearing and 4 in. of span only. No preparation of the under floor, beyond leveling, is required. The nail passes from the groove down through the carrying board and lattice support until it strikes the concrete and is bent back and clinched. The material is made by the C. J. Carter Lumber Co., Kansas City, Mo., and is sold through the Marsh & Truman Lumber Co., Chicago, and the Builders' Material Supply Co., New York City.



"BLOXONEND," A NEW WOOD FACTORY FLOOR